AN ECONOMIC EVALUATION OF CUSTOM HARVESTING OF POTATOES BY PACKING PLANTS

By

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A Dissertation Presented to the Graduate Council of
The University of Florida
In Partial Fulfillment of the Requirements for the
Degree of Doctor of Philosophy

UNIVERSITY OF FLORIDA
FEBRUARY, 1958

ACKNOWLEDGMENTS

The writer wishes to express his appreciation to Dr. R. E. L. Greene, Chairman of his supervisory committee, for assistance throughout the graduate program and particularly in the development of this study. He also appreciates the help and assistance of other members of his supervisory committee which they gave freely at all times. Those committee members are Drs. D. L. Brooke, E. W. Cake, M. R. Godwin and Ralph Blodgett. Recognition is also due Dr. G. L. Capel for help freely given throughout the graduate program.

Sincere appreciation is expressed to Mrs. Marie Charles and Mrs. Betty Herron who did a major portion of the work in preparation of rough drafts of the dissertation and to Mrs. Beth Story for her efforts in typing the final copy. The writer also recognizes the benefits of discussion and fellowship with all members of the staff and "the gang."

Finally, gratitude is extended to Mildred, Neil, Linda, and Karen for their sacrifices and understanding which have rendered this endeavor much easier than it might have been.

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CHAPTER 1

INTRODUCTION

Production of Irish Potatoes in Florida

Irish potatoes[1] are grown in all areas of Florida. Commercial production, however, is limited to a few areas of the State, Figure 1. Dade County in the southern tip of Florida and the Hastings area (St. Johns, Putnam, Flagler, and Clay counties) in East-central Florida are the two most important production areas. The Hastings area alone accounts for about half and both areas combined about three-fourths of Florida's total production.

Total acreage of commercial potatoes in the State has varied considerably since the 1919-20 season when it was 22,000 acres, Figure 2 and Table 52. Since then it has fluctuated both upward and downward. In the downward fluctuations, the lowest acreages were 16,000 in 1920-21, 17,000 in 1932-33, and 20,600 in 1948-49; peak acreages were 31,400 in 1937-38, 35,300 in 1945-46, and 41,700 in 1955-56. Since the 1948-49 season, land planted to potatoes has increased at a rapid rate, the acreage having doubled since that time.

During the twenty years prior to the 1948-49 season, per acre yield had increased slowly, but it had never been as high as 200 bushels. Since 1948-49, yield has exceeded 230 bushels per acre in all seasons. Favorable weather

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[1] Referred to only as potatoes in the remainder of this report.

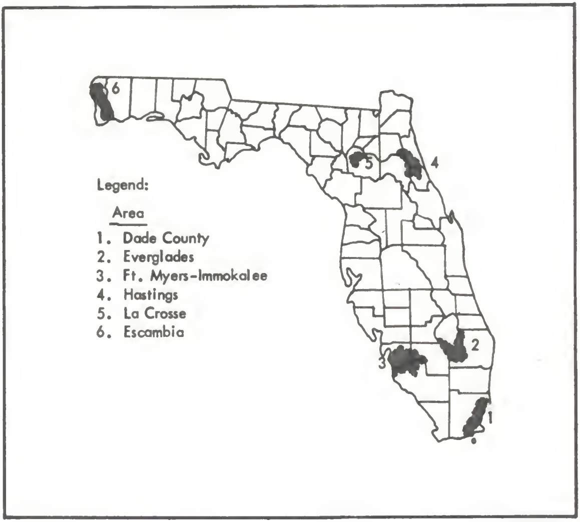

Fig. 1.--Principal commercial Irish potato producing areas in Florida.

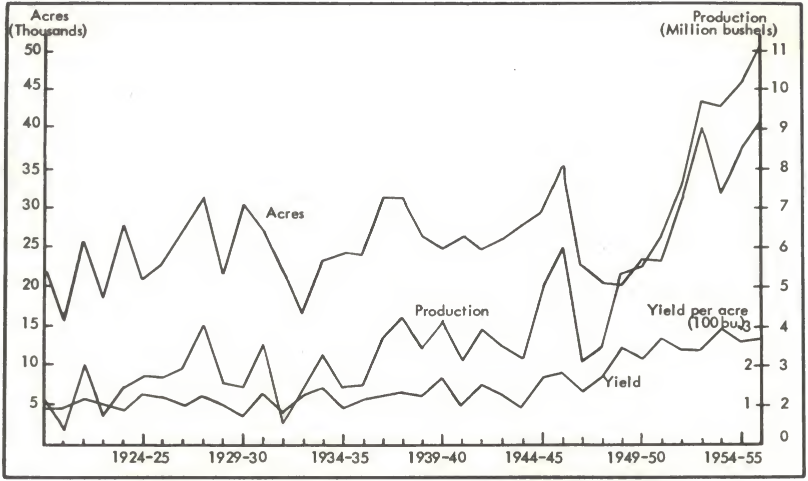

Fig. 2.--Acreage, yield per acre, and production of potatoes in Florida, 1920-1956.

Source: Florida Crop and Livestock Reporting Service, *Florida Vegetable Crops, Annual Statistical Summary*, United States Department of Agriculture, Agricultural Marketing Service, and University of Florida Agricultural Experiment Station, Department of Agricultural Economics, Orlando, Florida, 1945-1956.

conditions no doubt contributed significantly to the increase in yield. However, improved varieties and strains of potatoes, higher rates of fertilization, improved cultural practices, and availability of more effective materials for the control of diseases and insects have been important factors in increased yield.

Total production of potatoes has fluctuated widely from year to year due to changes in both acreage and yield per acre. It has varied from a low of approximately one and one-half million bushels in the 1931-32 season to over 10 and 11 million bushels in the 1954-55 and 1955-56 seasons, respectively.

The total value of the Florida potato crop has ranged from about 1.9 million dollars in the 1931-32 and 1932-33 seasons to 24.7 million dollars in the 1955-56 season. It was 8.3 million dollars in 1925-26 and did not again reach that amount until 1944-45. Average price per bushel varied from a low of $0.70 in 1937-38 to a high of $2.50 in 1947-48.

Production in Major Areas

The trend in potato production in recent years has varied among areas in Florida. Production in the Hastings area has increased rapidly, Table 1. Acreage has more than doubled since the 1948-49 season, and was estimated at 21,000 acres in both the 1954-55 and 1955-56 seasons. This was over one-half of the total acreage in Florida. Since the 1945-46 season, from 39 to 57 percent of the State's production has been in the Hastings area, Figure 3.

Acreage and production of potatoes in Dade County has increased at a less rapid rate than in the Hastings area. Total production in this area was rather stable for the four seasons 1952-53 to 1955-56. In this period acreage ranged

TABLE 1.--Acreage, yield per acre, total production and index of acreage, yield, and production of potatoes in the Hastings area, Dade County, and other areas in Florida, by seasons, 1945-46 to 1955-56

Season	Actual production			Index of production[a]		
	Acres for harvest	Yield per acre	Bushels produced	Acres for harvest	Yield per acre	Bushels produced
	(No.)	(Bu.)	(1,000)			
			Hastings Area			
1945-46	12,500	190	2,375	116	113	131
1946-47	9,500	149	1,416	88	88	78
1947-48	10,200	160	1,632	95	95	90
1948-49	9,900	255	2,524	92	151	140
1949-50	11,200	235	2,632	104	140	146
1950-51	12,500	285	3,562	116	169	197
1951-52	15,500	280	4,340	144	166	240
1952-53	19,300	245	4,726	180	151	261
1953-54	17,000	310	5,270	158	184	292
1954-55	21,000	265	5,565	196	157	308
1955-56	21,000	280	5,892	196	166	326
			Dade County			
1945-46	6,770	238	1,612	109	115	126
1946-47	6,050	172	1,040	97	83	81
1947-48	5,800	207	1,201	93	100	94
1948-49	6,700	297	1,991	108	143	155
1949-50	6,600	277	1,828	106	134	142
1950-51	5,700	294	1,682	92	142	131
1951-52	8,000	255	2,040	129	123	159
1952-53	10,800	280	3,024	174	135	236
1953-54	8,800	340	2,992	142	164	233
1954-55	8,400	320	2,688	135	154	209
1955-56	8,900	317	2,824	143	153	220

TABLE 1.-- Continued.

Season	Actual production			Index of production[a]		
	Acres for harvest	Yield per acre	Bushels produced	Acres for harvest	Yield per acre	Bushels produced
	(No.)	(Bu.)	(1,000)			
			Other Areas			
1945-46	16,030	126	2,017	170	109	185
1946-47	7,550	76	572	80	66	52
1947-48	4,700	144	679	50	124	62
1948-49	4,000	184	735	42	159	67
1949-50	5,800	183	1,064	62	158	98
1950-51	5,300	186	986	56	160	91
1951-52	6,300	187	1,176	67	161	108
1952-53	10,600	189	1,999	112	163	184
1953-54	6,600	215	1,420	70	185	130
1954-55	8,200	222	1,817	87	191	167
1955-56	11,800	219	2,583	125	189	237

Source: Florida Crop and Livestock Reporting Service, Florida Vegetable Crops, Annual Statistical Summary, United States Department of Agriculture, Agricultural Marketing Service, and University of Florida Agricultural Experiment Station, Department of Agricultural Economics, Orlando, Florida, 1946-56.

[a] Three seasons 1945-46 to 1947-48 = 100.

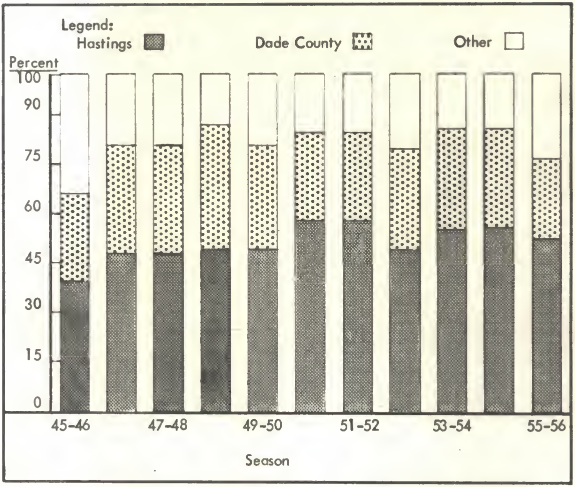

Fig. 3.--Percent of total production of potatoes in Florida produced in the Hastings, Dade County, and other areas, by seasons, 1945-46 to 1955-56.

from 8,400 to 8,900 acres. Since the 1946 season, Dade County has produced from 25 to 38 percent of the potatoes produced in the State each season.

Acreage in the Ft. Myers - Immokalee area (Lee, Collier, Glades, and Hendry counties) has increased rapidly within the last few years and was 4,100 acres in 1955-56.[2] The preliminary estimate is 8,100 acres for the 1956-57 season. Thus, this area has produced a significant portion of the State's crop in the last year or two. It remains to be seen whether the area will continue to produce a large volume of potatoes and become one of the major potato producing areas in Florida.

The Problem

In harvesting and handling in the conventional way a large amount of hand labor is required to pick up potatoes from the ground, load them on trucks, and unload them again at the packinghouse. The amount of labor required results in the entire operation being rather costly. In addition, potato growers report that labor has been increasingly difficult to obtain and cannot be fully relied upon when it is most needed.

Mechanical equipment suitable for harvesting and handling potatoes has been developed and is being used in the Hastings and Ft. Myers - Immokalee areas. The use of mechanical harvesting equipment in the Hastings area has increased rather rapidly since 1953. Indications are that in 1957 there were about 35 one-row and 50 two-row harvesters in operation in this area, or more than twice the number in use in 1956.

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[2] Florida Crop and Livestock Reporting Service, Florida Vegetable Crops, Annual Statistical Summary, 1956, United States Department of Agriculture, Agricultural Marketing Service, and University of Florida Agricultural Experiment Station, Department of Agricultural Economics, Orlando, Florida, p. 58.

Use of two-row mechanical harvesting equipment may reduce costs by as much as 5 to 10 cents per 100 pounds of packed potatoes, or 5 to 20 dollars per acre, if it is operated efficiently.[3] However, ownership of a two-row harvester and complementary equipment necessary to harvest and handle potatoes mechanically requires an investment of $8,000 to $10,000, excluding the tractor and trucks which are also necessary with the conventional system. Hence, in order to reduce per acre and per bag costs substantially below those of harvesting with the conventional system, the equipment must be used to harvest a relatively large acreage of potatoes. Previous research indicates that the average grower using the mechanical harvesting system in 1954 had to harvest at least 120 acres per year to reduce his costs below those of the conventional method.[4]

The average number of acres of potatoes per farm in the Hastings area in 1954 was 82, Table 2. It is known that some growers in the area had from 200 to more than 400 acres. Thus, apparently many growers had fewer than the average of 82 acres, or too few to justify ownership and operation of equipment for harvesting and handling potatoes in bulk.

Custom mechanical harvesting may be a possible means whereby growers with small acreages may obtain the benefits of bulk harvesting and handling of potatoes without having to own the equipment. Custom operation of harvesting equipment is widely practiced in harvesting crops such as wheat and cotton in other parts of the United States. However, this type of operation has been rather limited in potato harvesting in Florida. Growers with mechanical equipment have operated it very little on a custom basis. In most cases they have needed the equipment for their own use during the harvesting season. Technical problems and lack of complete understanding and agreement between the custom operators and the growers have resulted in dissatisfaction and may have interfered with an increase in the use of mechanical equipment on a custom basis. Also, when bulk harvesting and handling were first introduced, most packinghouses were not equipped to receive potatoes handled in bulk. This lack of facilities has limited the opportunity for custom operators.

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[3] J. S. Norton, R.E.L. Greene, and L. J. Kushman, Equipment for Mechanical Harvesting and Handling of Irish Potatoes in the Southeast, Florida Agricultural Experiment Station Bulletin 579, November 1956, p. 12.

[4] Hooper Clyde Spurlock, "An Economic Analysis of Mechanical Harvesting and Handling of Early Irish Potatoes in the Southeast" (unpublished Ph.D. Dissertation, Department of Agricultural Economics, University of Florida, 1956), p. 152.

TABLE 2.--Number of farms growing potatoes, total acres grown, and average acres per farm in specified years, Florida and Hastings area, 1940-54

Year	Florida			Hastings area[a]		
	Number of farms reporting	Acres		Number of farms reporting	Acres	
		Total	Per farm		Total	Per farm
1940	7,349	22,239	3.0	326	9,512	29.2
1945	7,771	27,671	3.6	271	11,792	43.5
1949	5,435	20,974	3.9	226	9,610	42.5
1954	5,467	32,187	5.9	209	17,093	81.8

Source: United States Department of Commerce, Bureau of the Census, Census of Agriculture, Washington, D.C., 1940, 1945, 1950, and 1955.

[a] Since only a small part of Clay County is in the Hastings area it was not included in this table.

Purposes of Study

Since private entrepreneurs have not performed custom mechanical harvesting, one alternative may be for marketing, or packing and selling firms, to own the bulk harvesting equipment and operate it on a custom basis. This system would seem to have definite possibilities in the Hastings area where a large proportion of the growers with small acreages relies on two firms, both cooperatives, to pack and sell their potatoes.

However, even though a marketing firm considered a system of custom harvesting to be economically feasible, some major problems would be encountered in its initiation and operation. In order to harvest and pack potatoes most economically, a greater degree of coordination of these operations would be required if potatoes were harvested and handled in bulk than if they were handled in the conventional manner. Such a harvesting system no doubt would necessitate packing for fewer growers on peak days than has been the case in the past. This would likely require some change in methods currently used in pooling prices to pay individual growers for their potatoes. Also, attitudes of growers and their unwillingness to cooperate on such a plan might present a problem. These and other problems would have to be given careful consideration.

The purposes of this study are to:

1. Explore the economic feasibility of custom mechanical harvesting of potatoes by marketing firms and to study the problems involved.
2. Briefly point out alternative means whereby growers with small acreages might obtain the services of equipment to harvest and handle potatoes in bulk.

Method of Study

Sampling and Data Collected

To study the problem, two firms (cooperative associations) in the Hastings area were selected. Their patrons comprise a relatively large proportion of growers in the area who have small acreages and about 50 percent of the total number of growers in the area in 1954 as reported by the agricultural census. For the purpose of this study it was not considered necessary to include all of the packinghouses operated by the two firms; therefore, one packinghouse of each firm was selected on a judgment basis.[5] The houses[6] were selected so that estimated costs of custom harvesting by the firms could be compared for houses that varied widely in respect to volume of potatoes packed and number of days of operation during the harvesting season.

Data were obtained from records of the firms and from individual growers. Data obtained from the firms pertained to volumes of potatoes packed and to pool prices. Volumes packed for individual growers at each sample plant in 1956 were recorded by dates. Pool price data included daily pool prices and daily volumes of Grade A potatoes sold for individual patrons of one firm in 1954, 1955, and 1956 and for those of the other firm in 1955 and 1956. In the case of one firm this information pertained only to those potatoes packed at packinghouses operated by the association.

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[5] Growers and packinghouses in Flagler County were not included in the study. This section is very similar to the rest of the area in harvesting and marketing practices.

[6] The terms packinghouses, houses, packing plants, and plants are used synonymously in this report.

A random sample of patrons who used the conventional system of harvesting in 1956 was chosen for each of the two firms. Those considered eligible to be included were members of the associations who had operated a farm in the area for at least one year prior to the 1955-56 season and who had potatoes packed in 1955-56 at plants operated by the associations. Partnerships were treated as individuals and information on their combined operation was obtained from only one of the partners. Of a total of 50 eligible growers, 23 were included in the study.

In addition, an attempt was made to include all of the firms' members who used mechanical harvesters in 1955-56. Records were obtained from five who used one-row harvesters and six who used two-row harvesters. However, data obtained for the latter method were used only to supplement similar data collected in a previous study in calculating costs of custom harvesting by marketing firms.[7]

Data were obtained from growers by personal interview. Information collected pertained primarily to their costs of harvesting potatoes in 1956. However, general information was also obtained on problems of getting potatoes packed when desired, opinions of growers relative to feasibility of their organizations' owning and operating bulk harvesting equipment and problems thereof, and opinions relative to price pools of various specified durations of time.

Procedure of Analysis

Costs of harvesting in 1956 were estimated from information obtained from growers. Costs were calculated separately for each grower who used the conventional system or a one-row harvester. In the case of those growers using the conventional system, an average cost was calculated for the patrons of each firm. However, it was deemed desirable to present costs by groups of growers having similar sized operations and using the same harvesting methods and practices regardless of which firm the growers patronized. Where possible, costs were presented by harvesting operations and by cost items.

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[7] Spurlock, pp. 137-162.

Hypothetical custom mechanical harvesting units were determined for each of the two packinghouses selected. These custom harvesting units were assumed to include all equipment and labor that would have been required to supply each packinghouse with the volume of potatoes packed daily and weekly in 1956. Rates of harvesting of 128 and 150 bags of potatoes per harvester hour were also assumed. Estimated costs of harvesting with the different units were compared. They were also compared with the harvesting costs incurred by growers in 1956. Comparisons were made on the bases of total costs, costs of labor and equipment, fixed and variable costs, and amount of investment required.

Custom harvesting units that would have been required to harvest the potatoes packed at all plants, except those at Bunnell, of each firm were also determined. The same assumptions were made in calculation of these units and costs of operating them as were made in determining the units and costs for individual plants. Costs of harvesting with these units were compared with those of the units set up for the individual plants.

In addition to the analysis of costs of custom harvesting by the firms and comparison of these costs with those incurred by growers in 1956, various problems of the hypothetical custom harvesting arrangement are discussed. The problems are those foreseen by the growers interviewed as well as those which would logically seem to be important. The custom harvesting units probably could not harvest for as many growers in one day as the plants usually packed and sold for in 1956. Since some growers likely could not get their potatoes packed on the day they desired, some pricing system other than the traditional one of pooling prices on a daily basis might be desirable. To study this problem, daily pool prices received and volumes of potatoes sold were analyzed to determine effects of price pools of various durations of time upon returns to individual growers and certain groups of growers.

Other problems considered are coordination of the harvesting and packing operations, growers' attitudes and opinions relative to custom harvesting by the marketing firms, and determination of the order in which individual growers' potatoes would be harvested. All of these would be important in custom harvesting by the firms and would require careful consideration. For successful and economical operation of such custom harvesting arrangement, some satisfactory solution of each of these problems would be necessary.

It is realized that the sample on which this study is based was small and the data do not necessarily represent all growers in the Hastings area. However, it is believed the data do adequately represent the two firms studied as to the average cost of harvesting by the conventional method and also give a reasonable estimate as to needed investment in equipment and probable cost of the firms engaged in custom mechanical harvesting.

CHAPTER 2

TIME AND SYSTEMS OF HARVESTING IN THE HASTINGS AREA

The Hastings potato producing area is comprised primarily of parts of St. Johns, Flagler, and Putnam counties but also includes a very small part of Clay County, Figure 4. From the southeast corner of Clay County, the area extends east and south to include the southwest quarter of St. Johns County, the northwest quarter of Flagler County, and a narrow strip of the east side of Putnam County. However, approximately one-half of the total production of potatoes in the area is in St. Johns County.[1] Practically all the rest of the production is about equally divided between Putnam and Flagler counties. In recent years production in Flagler County has exceeded that in Putnam County.

Time of Harvesting

Harvesting of potatoes in the area usually starts about April 1 and continues until about June 1. The exact dates vary from year to year. In the last eight years the harvesting season has begun as early as March 27 and as late as April 15, and it has been completed as early as May 18 and as late as May 27 according to

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[1] Federal-State Crop Reporting Service, Acreage and Production by Counties, 1940-55.

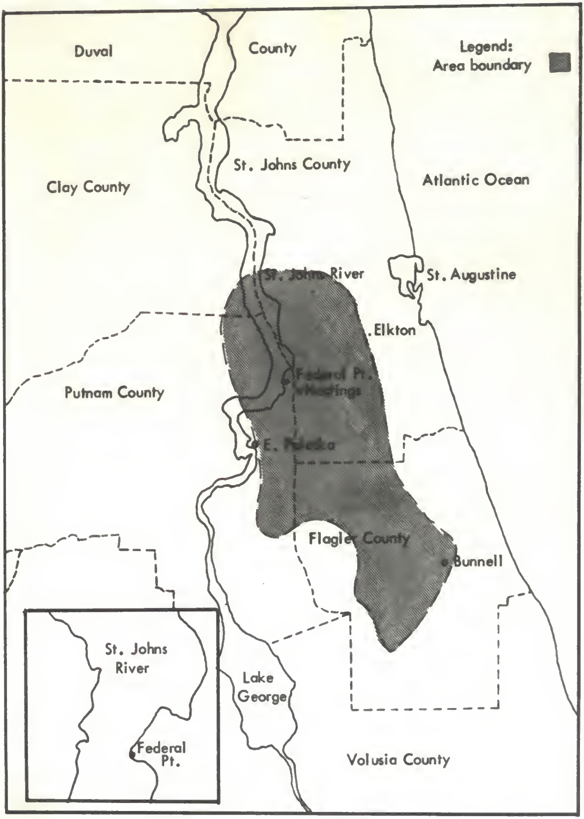

Fig. 4.--Hastings potato producing area.

Federal-State Market News Service reports.[2] Volume of potatoes harvested is usually rather low during the first few days of the season and gradually increases until it reaches a peak that lasts during two to three weeks of the season. Although the exact pattern varies from year to year, the data in Figure 5 give a general idea of the usual variation within a season. Weather and prices, both current and expected, influence the general pattern of harvesting.

Time of harvesting potatoes varies considerably among different localities in the Hastings area. The Bunnell section, in Flagler County, is about 30 miles south of the major portion of the area and is closer to the Atlantic Ocean than is the major part of the rest of the area. The Federal Point section is located near Hastings, but in Putnam County, in a bend of the St. Johns River and is bounded on three sides by the river. Since fluctuation of temperature is less rapid over water than over land, these areas receive more protection from cold "snaps" and are less subject to late freezes and frosts than are other parts of the area. For this reason, farmers around Bunnell and Federal Point plant their potatoes earlier than farmers in other sections.

Ordinarily most of the potatoes harvested in the area during the first two weeks of the season is in the Bunnell and Federal Point sections. The peak period of harvesting is often over in these sections before it occurs in the rest of the Hastings area. Only a small portion of the total volume harvested in the last three weeks of the season is in the Bunnell and Federal Point sections.

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[2] Federal-State Market News Service, Potato Report, United States Department of Agriculture, Agricultural Marketing Service, Fruit and Vegetable Division, and Florida State Marketing Bureau cooperating, 1950-56.

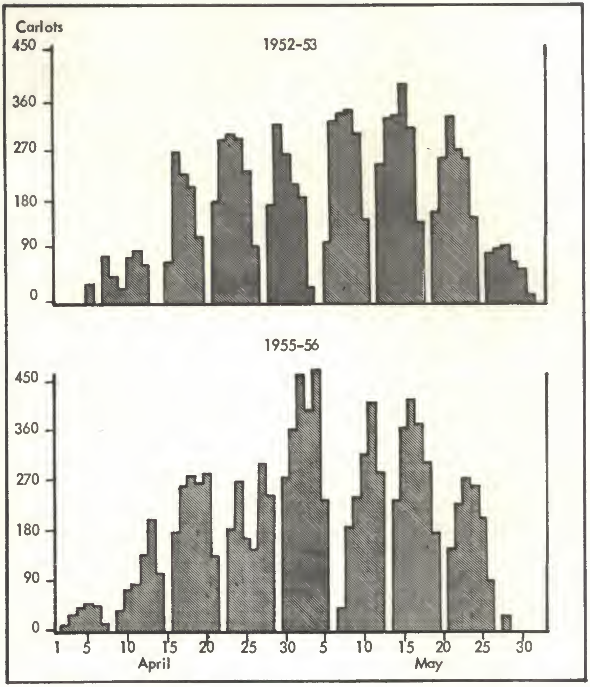

Fig. 5.--Total carlot shipments of potatoes from the Hastings area, Florida, by dates, 1952-53 and 1955-56 seasons.

Source: Federal-State Marketing News Service, Potato Reports, United States Department of Agriculture, Agricultural Marketing Service, Fruit and Vegetable Division and Florida State Marketing Bureau cooperating, Hastings, Florida, 1953 and 1956.

Differences among localities of the area in time of harvesting might permit use of mechanical harvesting equipment in more than one area. This would provide an opportunity for custom operators to obtain more business and to harvest a greater volume of potatoes than they could otherwise. Thus, fixed costs resulting from the high investment in bulk harvesting equipment might be reduced on a per acre and per bag basis.

Systems of Harvesting and Handling Potatoes

Several systems of harvesting and handling potatoes are used in the Hastings area. Each of the systems involves use of a potato digger or a potato harvester equipped with digger blades to get the potatoes out of the ground. Different procedures may be used thereafter.

The Conventional System

In the past, most of the growers have used the conventional system of harvesting and handling their potatoes. With this system, potato vines and weeds are removed by rotobeaters before the potatoes are dug. The time lapse between rotobeating and digging is usually a few hours but may be as long as several days.[3] The potatoes are removed from the ground by use of a digger which lifts the potatoes out of the ground, separates them from dirt and clods, and deposits them back on top of the ground behind the digger. Ordinarily they are picked up right after being dug, or they are left on the ground for only a short time as they may be damaged rather quickly by exposure to the weather, especially sunshine.

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[3] Spurlock, p. 36.

Workers pick up the potatoes by hand and place them in baskets. From the baskets they are poured into field sacks, which ordinarily are used potato or fertilizer bags. Two baskets, or about 65 to 70 pounds, of potatoes are usually put into a field bag.

In moving the potatoes from the field to the packinghouse one of two procedures is used. The more common method is to load the field sacks of potatoes by hand onto flat-bed trucks on which they are hauled to the packinghouse. At the packinghouse the field sacks are unloaded manually. The potatoes may be emptied from the bags directly onto the packing line, or they may be placed in temporary storage by setting the bags in special racks on the packinghouse platform or by pouring the potatoes into bulk bins.

An alternative to handling and hauling the potatoes in field sacks, but one used by only a few growers, is to handle them in bulk. With this method, potatoes are poured from field sacks into the hopper of a field elevator which loads them into a special hopper type body mounted on a truck or trailer. The elevator is pulled through the field by a tractor. The hopper shaped bodies are equipped with a conveyor in the bottom for unloading the potatoes. Unloading is accomplished by use of a small electric motor that is attached by belt to the conveyor in the bottom of the bulk body. At the packinghouse the potatoes are unloaded directly onto the packing line, or they are placed, by use of an elevator, into bulk bins for temporary storage.

Harvesting and handling potatoes from the field to the packinghouse by the conventional system requires a great deal of hand labor. The bulk hauling system eliminates most of the very heavy, strenuous labor of lifting the field sacks of potatoes, but does not substantially reduce the total amount of labor required in the entire harvesting operation since most of the labor is required in picking up the potatoes.

Mechanical Harvesting

Mechanical harvesters are machines that dig the potatoes, separate them from vines, weeds, and dirt, and convey them into sacks or directly into bulk trucks. Rotobeaters normally are not used ahead of mechanical harvesters. Both one- and two-row harvesters are used in the Hastings area. The two-row harvesters convey the potatoes into bulk trucks driven through the field beside the harvester.[4] The potatoes are then handled in bulk as in bulk handling with diggers. There are several makes or models of two-row harvesters in use in the area. All except two models are of the trailer type and are pulled behind a tractor. They are powered either by motors mounted on the harvester or by the power take-off of the tractor. A few growers began using a self-propelled model of one manufacturer in 1955. A harvester built to be mounted on any of several makes of tractors was introduced into the area during the 1956-57 season.

Only one make of a one-row harvester is used in the area. It conveys the potatoes into field sacks. When filled, the sacks are placed on a platform on the harvester and carried to the end of the row where they are loaded onto flat-bed trucks or are set on the ground. They are then hauled and handled at the packinghouse as they are when dug by the conventional digger.

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[4] The terms "two-row harvester" and "bulk harvester" are used synonymously in the rest of this study.

Extent of Use. -- Mechanical harvesters were not used at all in Florida until 1945.[5] During that season two farmers at Hastings used a one-row machine which they themselves had built. As late as 1952 only three one-row harvesters were used in the area, and these by the same growers who had built the first harvester used there. In 1954 there were six two-row harvesters in addition to 11 one-row harvesters in the area.

Since 1954, the use of mechanical harvesting and handling equipment has increased rapidly. The two farmers who developed the first harvester used in the area have since built harvesters, both one-row and two-row, on a commercial basis, and several commercial companies have sold two-row harvesters in the area. In 1956 there were an estimated 15 one-row and 20 or more two-row harvesters in operation. Reports indicate that in the 1957 season the use of harvesters had more than doubled, and that there were about 35 one-row and 50 two-row harvesters in the area.

These 85 harvesters probably harvested from 25 to 30 percent of all the potatoes in the area in 1957, or about four to six thousand acres. In 1954 mechanical harvesters were used to harvest 1,277 of the 17,000 acres grown in the Hastings area.[6] Of the 1,277 acres, 755 were harvested and handled with two-row harvesters and bulk handling equipment.

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[5] R. E. L. Greene, L. J. Kushman, J. S. Norton, and H. C. Spurlock, Mechanical Harvesting and Bulk Handling of Potatoes in Florida and Alabama, Agricultural Economics Series No. 54-10, Florida Agricultural Experiment Station, January 1954, p. 18.

[6] Unpublished data, Florida Agricultural Experiment Station.

CHAPTER 3

POTATO PACKING OPERATIONS AND MARKETING SERVICES PROVIDED BY THE FIRMS STUDIED

The firms included in this study provided potato packing and marketing as well as other services to their members located in all sections of the Hastings area. The location and operation of packinghouses in or near all sections could be of importance with respect to custom operation of bulk harvesting and handling equipment. Since the peak periods of harvesting vary among localities, the firms might be able to operate the same equipment in two or more sections during the same season. This would make the custom harvesting operation less costly on a per acre or per bag basis. Services performed by the field departments of the firms would facilitate the coordination of the custom harvesting and packing operations. On the other hand, the practice of pooling prices on a daily basis might present a major problem in custom harvesting and handling of potatoes for the patrons.

Packing Operations of Firms Studied

Extent of Packing Operations

The two cooperatives operated nine packinghouses in 1956. One house was leased from a member and the rest were owned outright. Four of the plants are located in or near Hastings, two in Elkton, two in Bunnell, and one in East

Palatka. One firm has a large and a small plant in the same town. However, these two plants were not in operation simultaneously in 1956. Both cooperatives also contracted the packing of some potatoes at privately owned plants, and some members packed their own potatoes.

Each firm packed some potatoes for non-members. They limited this non-member service to those who were either employees or members of the firm, to public organizations such as schools and the Potato Investigation Laboratory at Hastings, and to independent growers with small acreages who could not get their potatoes packed elsewhere at the time. Of course, members were given priority.

The two firms sold a total of 1,193,232 hundredweight of potatoes in 1956, or 34 percent of the total production in the area. Practically all of the total volume belonged to members. Only 60 percent of the total volume sold by the firms was packed at packinghouses operated by them. Volume sold and not packed in houses operated by the association was packed mainly in houses owned by members of the association. The total of 7,445 acres of potatoes grown by members of the two associations was slightly over 35 percent of total acreage in the area.

Volumes Packed and Number of Growers Patronizing the Plants Studied

As mentioned previously, the plants chosen for study were selected primarily because of the difference in length of time they were operated, the volume of potatoes they packed, and the number of patrons each served in 1956. Plant A operated a total of 38 days while Plant B operated only 25 days during the season, Figure 6 and Table 3. Total volumes packed were 131,838 and 63,578 hundredweight equivalents at Plant A and Plant B, respectively. Volumes packed daily at each

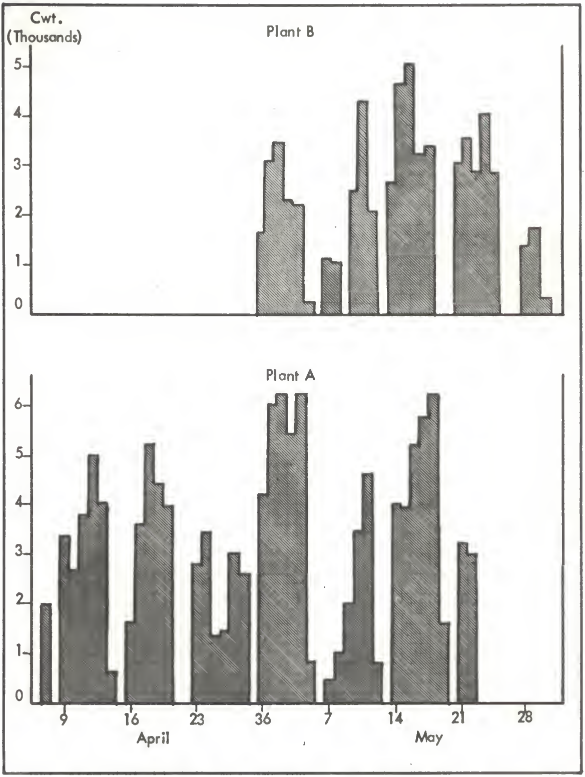

Fig. 6.--Daily volumes of potatoes packed by Plants A and B, Hastings area, Florida, 1956.

TABLE 3.--Hundredweight of potatoes packed, by dates of operation, Plants A and B, Hastings area, Florida, 1956

Dates	Day of week						Weekly total	Average per day of operation
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday		
				Plant A				
April 2-7	.....	.....	.....	.....	.....	2,030	2,030	2,030
April 9-14	3,370	2,731	3,801	5,034	4,018	674	19,628	3,271
April 16-21	1,697	3,662	5,261	4,566	4,036	.....	19,222	3,844
April 23-28	2,864	3,434	1,450	1,450	3,114	2,608	14,920	2,487
April 30-May 5	4,245	6,051	6,236	5,545	6,329	946	29,352	4,892
May 7-12	561	1,100	2,114	3,584	4,779	987	13,125	2,188
May 14-19	4,121	4,019	5,268	5,811	6,312	1,756	27,287	4,548
May 21-22	3,237	3,037	.....	.....	.....	.....	6,274	3,137
Total	20,095	24,034	24,130	25,990	28,588	9,001	131,838	.....
Days operated	7	7	6	6	6	6	38	.....
Average per day	2,871	3,433	4,022	4,332	4,764	1,500	......	3,469
				Plant B				
April 30-May 5	1,785	3,140	3,477	2,383	2,267	219	13,271	2,212
May 7-12	1,109	1,055	.....	2,530	4,309	2,098	11,101	2,220
May 14-19	2,791	4,655	5,172	3,259	3,397	.....	19,274	3,855
May 21-26	3,095	3,597	2,860	4,017	2,895	112	16,576	2,763
May 28-June 2	1,397	1,761	198	.....	.....	.....	3,356	1,119
Total	10,177	14,208	11,707	12,189	12,868	2,429	63,578	.....
Days operated	5	5	4	4	4	3	25	.....
Average per day	2,035	2,842	2,927	3,047	3,217	810	......	2,543

plant varied widely throughout the season. However, on the average approximately 36 percent more potatoes were packed daily at Plant A than at Plant B.

Plant A packed for as many as eight growers on each of five days, and Plant B for as many as nine on one day, Table 4. The former packed for five or more growers on 17 days, and the latter for the same number on 14 days. At each house potatoes were packed for only one grower on at least one day of the season. Each of these days was Saturday. It is likely that potatoes packed on these days

TABLE 4.--Number of growers for whom potatoes were packed, by dates, Plants A and B, Hastings area, Florida, 1956[a]

Dates	Day of week					
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			Plant A			
April 2-7	...	...	...	...	...	3
April 9-14	5	5	4	5	4	1
April 16-21	4	4	5	4	3	...
April 23-28	4	4	3	3	3	4
April 30-May 5	6	8	6	8	8	3
May 7-12	3	3	4	5	6	3
May 14-19	7	8	6	7	8	5
May 21-22	3	3	...	...	...	...
			Plant B			
April 30-May 5	3	4	5	5	3	1
May 7-May 12	4	4	...	3	5	5
May 14-19	6	6	6	9	8	...
May 21-26	5	7	6	8	7	1
May 28-June 2	4	2	2	...	...	...

[a] A total of 27 growers patronized Plant A and 12 growers patronized Plant B.

were left over from Friday and packed Saturday to avoid holding them over until the following Monday.

Plant A packed potatoes for 27 growers in 1956 while Plant B packed for only 12, Table 5. Most of the patrons of Plants A and B also patronized other packinghouses operated by their association. Only 12 of the 27 patrons of Plant A utilized the packing services of that plant only. However, for each of 19 growers, over half of the potatoes packed by the firm for them was packed at Plant A. Of the total volume of potatoes that the cooperative packed for all 27 growers, about two-thirds were packed at the one plant. About the same situation existed at Plant B. Eight of the 12 patrons of this plant also had potatoes packed at other plants operated by the association. However, only one patron of Plant B had less than half of his

TABLE 5.--Number of patrons and amounts of potatoes they had packed at Plants A and B and at all plants of the firms that operated these plants[a]

Item	Plant A	Plant B
Number of patrons	27	12
Number of patrons who packed:		
All their volume at this plant	12	4
One-half or more of their volume at this plant	19	11
Acres packed per patron at:		
This plant	31	33
All plants of same firm	47	46
Percent of total acreage packed at this plant	64	72
Number of patrons who packed:		
50 acres of potatoes at this plant	5	3
75 acres of potatoes at this plant	2	2
100 acres at all plants of same firm	1	0

[a] See Tables 53 and 54 for detailed data upon which this table is based.

total volume packed there, and the average for all growers was almost three-fourths.

In estimating acreages of potatoes packed at each plant, a yield of 160 bags per acre was assumed. Based on this yield, Plant A packed an average of 31 acres of potatoes for each of its patrons. Other houses operated by the firm packed an additional 16 acres per patron. Only two growers had potatoes from as many as 75 acres packed at Plant A. Only one grower patronizing Plant A had as many as 100 acres of potatoes packed at all plants of the association. The estimated numbers of acres from which potatoes were packed for patrons of Plant B were approximately 33 at Plant B and 46 at all plants operated by the association.

The daily volumes of potatoes packed for each of 12 patrons who had an estimated 25 acres or more of potatoes packed at Plant A in 1956 are shown in Table 6. These 12 growers supplied 70 percent of all the potatoes packed at Plant A in 1956. Generally, fewer than 1,000 bags were packed for an individual grower on a single day. Only in ten instances were more than 1,500 bags packed for an individual grower on one day. Thus, it appears that the potatoes could be custom harvested by marketing firms but still follow fairly closely the digging schedules followed by individual growers.

Services Provided by the Firms

In addition to the potato packing operations, both firms perform a number of other services for their patrons. These include services such as the purchase of farm supplies, extension of credit, and packing and selling of cabbage and flowers. While these services are of importance to the patrons and to the successful operation of the firms, they are not of particular importance insofar as this study is concerned.

TABLE 6.--Number of hundredweights of potatoes packed, by growers and by dates, 12 growers who harvested an estimated 25 acres or more, Plant A, Hastings area, Florida, 1956

Date	Hundredweight packed by grower number:											
	20[a]	8	14	13	7	9	18	11	10	15	6	19
April 10	647											
11	664											
12	1,055	992	1,430									
13	824	1,588	1,800	650								
14	845	1,221	525	1,427								
15				674								
April 17	209	691		178								
18		1,134	518	774	1,100							
19		734	1,550	940	1,127							
20		888	915		2,364							
21			725									
22												
April 24						1,402						
25						1,149						
26						700						
27				260		280						
28				694		1,348						
29				595		1,284						
May 1	523			328			680	1,604	552			
2	1,284			174			1,404	1,606	426			
3	610			914			1,060	2,016	912			
4	764			628			1,000	1,176	586			
5	465			740			1,098	264	744			
6							254		574			

TABLE 6--Continued.

Date	Hundredweights packed by grower number:											
	20[a]	8	14	13	7	9	18	11	10	15	6	19
May 8									160			
9									782	166		
10									738	310		
11						1,146			664	668		
12									702	1,188	1,281	
13										248	506	
May 15							1,176		230	513	1,317	137
16							556	650		487		909
17							1,010	1,513		660	886	1,118
18				1,148			954	333		326	496	1,816
19				2,938			522			382		1,546
20				188			313					287
May 22				1,113								
23				386								
Total	7,890[a]	7,248	7,463	14,749	4,591	7,309	10,027	9,162	7,070	4,948	4,486	5,813
Estimated acres	56	45	47	93	29	46	62	57	44	31	28	36
Percent of total acreage packed at Plant A	49	100	85	96	100	100	76	100	100	81	100	71

[a] Grower 20 packed an additional 913 hundredweight on April 7.

Whether these services are provided,and to what extent,would not influence or be influenced by the system and arrangement of potato harvesting that growers use or that the firm might enter into. Hence, the discussion of services provided by the firms is limited to those that would affect performance of custom harvesting by the firms.

Market Information and Field Service

During the harvesting season, each of the cooperatives attempts to keep grower-patrons informed of current price and market conditions and expectations for the immediate future. This is accomplished through a field man and use of two-way radios. Management gives information to the field man who circulates among the growers and passes the information along to them. In addition, the field man attempts to determine growers' intentions to harvest, including volumes expected to be harvested in the immediate future. This information is passed back to the association headquarters. Thus, both management and growers are better able to keep abreast of market conditions, volume of potatoes that the packinghouses can and will be expected to handle, and the approximate rate at which growers expect to harvest potatoes.

In the event that growers start harvesting faster than the packinghouses can pack, the growers are so informed and are encouraged to slow down their rate of harvesting or to stop altogether. This gives the packinghouses an opportunity to catch up with the grading and packing. It also permits patrons to plan their harvesting operations so that the potatoes will not be exposed to the weather too long prior to packing.

The field departments could be of prime importance in the operation of custom mechanical harvesting and handling equipment. They could assume the responsibility of overseeing the operation of the equipment and thus, the custom harvesting service could be introduced without a major change in this phase of the organizational structure. Also, the liaison between growers and management would be of considerable importance in coordinating the harvesting and packing operations.

Selling and Price Pooling

Although potatoes of some members of each firm are not packed at association operated plants, associations perform all services involved in selling the potatoes. Receipts from the sales of potatoes are pooled daily on a grade basis. In addition to the different price pools for different grades of potatoes, one firm has separate pools for potatoes packed at plants operated by the association and for those packed at each of the other plants patronized by the firms' members. At both firms, the price received by a grower is the average price received for all potatoes in the particular pool in which his potatoes were sold. For example, suppose a grower-member, of the firm with separate price pools for potatoes packed at association operated plants and at other plants, had potatoes packed at a plant operated by the association. He would be paid the average price received for all Grade A and Grade B potatoes packed at plants operated by the association and sold the same day his were sold. For potatoes packed at a privately operated plant, a grower would be paid the average price received that day for all Grade A and Grade B potatoes that were packed at the plant by members of the association.

In the event that a shipment of potatoes is not in grade when it reaches its destination and must be sold for a price lower than that originally agreed upon by the firm and the buyer, returns from the potatoes reduced in price are excluded from the price pool. Growers with potatoes in the shipment are paid whatever price is obtained. If possible, the firms include in each shipment of Grade A potatoes only those of one grower.

CHAPTER 4

COSTS OF HARVESTING POTATOES IN 1956

Information used in estimating costs of harvesting in 1956 was obtained from patrons of the two firms included in the study who used the conventional system or one-row harvesters. Costs were those incurred by the growers with the harvesting method used and not necessarily those that could be expected by a grower contemplating future use of such a method. The cost data were summarized for patrons of each firm separately but were combined for presentation.

Practices in the performance of harvesting operations with the conventional system varied considerably among growers in the Hastings area. All of the 23 growers interviewed hired their potatoes picked up and hauled to the packinghouse. Picking-up and hauling were usually contracted to the foreman of an itinerant labor crew at a flat rate per field bag or per packed bag[1] for both operations combined. Some growers hired and supervised their own crews in picking up potatoes, but this type of operation was included with that performed on a custom basis. Twelve growers hired only picking-up and hauling. Five growers hired rotobeating, picking-up, and hauling with digging being the only operation performed by the operator. Seven growers hired all harvesting operations performed. In all, about one-third of the rotobeating and one-sixth of the digging were done by custom operators, Table 7.

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[1] In the rest of this report the words bag and packed bag will mean 100 pounds of packed potatoes or their equivalent, unless otherwise stated.

TABLE 7.--Acres on which specified operations in harvesting with the conventional system were performed by custom operators, 23 growers, Firms 1 and 2, Hastings area, Florida, 1956

Firm	Total acres harvested	Acres performed by custom operators			
		Rotobeat	Dig	Pick up and haul	All Operations[a]
1	662	267	117	662	87
2	635	182	110	635	70
Total	1,297	449	227	1,297	157

[a] Also included in individual operations.

In addition to the conventional digging hired performed by custom operators, four growers hired a portion of their potatoes harvested with mechanical harvesters. Three of the growers utilized one-row harvesters and the fourth a two-row harvester. However, only 91 acres of potatoes were harvested mechanically for these growers.

Method of Calculation and Presentation of Costs

Items of cost in harvesting potatoes with the conventional system included labor and equipment in rotobeating, digging, picking up, and hauling the potatoes. The only labor used in rotobeating was that of the tractor driver. In digging potatoes, some growers used a man on the digger in addition to the tractor driver. These labor costs were computed from growers' reports of amounts used and wages paid. Items of equipment costs in rotobeating and digging were charges for depreciation, interest, insurance, taxes, repair, and miscellaneous cost items in use of equipment and a charge for the use of tractor. Labor and truck use in picking up and hauling potatoes were contracted and paid for on a field bag or packed bag basis. In addition to labor and truck use included in the contract cost, baskets and sacks were items of cost in picking up and hauling potatoes.

The cost of tractors was charged at rates of $.75, $.85, and $1.00 per hour of use for small, medium, and large tractors, respectively.[2] In estimating depreciation of rotobeaters and diggers, the equipment was assumed to depreciate the same amount for each year of use. Depreciation cost was based on the grower's purchase price and estimated life of the equipment. Interest, insurance, and taxes were charged at rates of 3, 1, and 1 percent of the purchase price, respectively.[3] Costs of repair and miscellaneous items were those reported by the growers.

Except for costs of the baskets and sacks, cost of picking up and hauling potatoes was the contract rate reported by the growers. A majority of the growers paid one fee that included payment for both operations. However, nine of the 23 growers using the conventional system paid for these operations separately. Of the total paid by these nine growers for picking-up and hauling, 54 percent was for picking-up and 46 percent was for hauling. These proportions were used in dividing costs of picking-up and hauling potatoes for all growers. Hauling cost was divided equally between truck use and labor since growers generally consider this to be the approximate division.[4] Costs of mechanical harvesting hired by growers using the conventional system were included only in the calculation of total harvesting cost of individual growers.

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[2] These rates are the same as those used in a previous research study that included costs of harvesting potatoes in the Hastings area. They were based upon a study of tractor costs incurred by farmers in Florida adjusted for changes in cost items. See John M. Johnson, "Amount of Use and Cost of Operating Farm Tractors in Florida" (unpublished Master's thesis, Department of Agricultural Engineering, University of Florida), p. 37.

[3] Charging interest at 3 percent of purchase price is equal to approximately a 5 percent charge on undepreciated balance.

Items of cost in harvesting with one-row mechanical harvester include use of the tractor, equipment costs of operating the harvester, field bags, labor used to drive the tractor, operate the harvester, and pick up potatoes that pass over and fall behind the harvester, and cost of hauling the potatoes. Costs of these items were computed in the same manner as were those of harvesting with the conventional system.

In cases where growers used their equipment on a custom basis for other growers, costs of the equipment were allocated according to the proportion of use on the operator's farm was of total annual use.

Data are first presented for growers who harvested their potatoes primarily with the conventional system and then for those who harvested with one-row harvesters. In the case of the conventional method of harvesting, the data are summarized to show cost of harvesting by size of grower and also according to operations growers hired performed on a custom basis. The cost figure for conventional harvesting includes the cost of the small acreage harvested with mechanical equipment. One grower hired all operations performed on a portion of his acreage but only picking-up and hauling on the rest. In the summary of cost by operations hired performed on a custom basis, cost for this grower was summarized in two groups based on the acreage harvested by each method. The cost of field sacks and baskets was allocated in proportion to the acreage handled in each way.

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[4] D. L. Brooke, unpublished data, Florida Agricultural Experiment Station.

Twelve growers hired only picking up and hauling of potatoes. Detailed data are presented for this group by operations and cost items. To study differences in harvesting costs due to size of operation, these growers were divided into two groups according to acres of potatoes harvested.

Costs of Harvesting Potatoes by Growers Using Mainly the Conventional System

Average Costs by Acreage Harvested

The average cost of the 23 growers who harvested most of their potatoes with the conventional system was $55.18 per acre, or 33.05 cents per bag, Table 8. The difference in cost among growers was rather wide, the range being from 26.67 to 42.30 cents per bag and from $32.91 to $73.95 per acre. There was little difference in the average costs incurred by the growers who harvested less than 50 acres of potatoes and those who harvested 50 to 99 acres. Costs of each of these groups were about $6.00 per acre, or 4.5 cents per bag, higher than that of growers who harvested 100 acres or more. In the conventional system, increasing the acres harvested does not have a marked effect on the per unit cost of harvesting. Items of cost comprising a major share of total cost are paid for on a per unit basis. The rates paid for these items are affected very little by volume or acreage harvested.

Average Costs by Operations Hired Performed

Average costs of harvesting with the conventional system varied among groups of growers according to the harvesting operations that they hired performed on a custom basis. Cost was highest for the group of growers who hired all of the harvesting operations performed, Table 9. Their cost was about 3.9 cents per bag

TABLE 8.--Costs of harvesting potatoes, by size of operation, 23 growers who used mainly the conventional system, Firms 1 and 2, Hastings area, Florida, 1956[a]

Size group and grower number	Amount harvested			Costs		
	Total acres	Hundredweight equivalent		Total for season	Amount per acre	Amount per 100 lb. packed bag (cents)
		Total number	Number per acre			
			Less than 50 acres			
1	8	1,288	161	$ 458	$57.25	35.56
19	20	3,000	150	851	42.55	28.36
2	20	3,560	178	1,479	73.95	41.54
8	25	3,525	141	1,213	48.52	34.41
3	30	2,700	90	1,085	36.17	40.18
4	30	4,830	161	2,043	68.10	42.30
9	30	6,750	225	1,978	65.93	29.30
21	35	4,550	130	1,778	50.80	39.08
10	35	8,750	250	2,412	68.93	27.56
22	40	6,000	150	2,186	54.65	36.43
6	40	6,400	160	2,671	66.78	41.73
11	40	6,880	172	2,137	53.42	31.06
Total or average	353	58,233	165	$20,291	$57.48	34.84
			50 to 99 acres			
5	60	6,000	100	$ 2,301	$38.35	38.35
20	60	11,220	187	4,238	70.63	37.77
7	65	9,100	140	3,513	54.05	38.60
12	75	10,875	145	3,986	53.15	36.65
13	75	15,000	200	5,060	67.47	33.73
14	80	16,000	200	5,073	63.41	31.71
Total or average	415	68,195	164	$24,171	$58.24	35.44

TABLE 8 -- Continued

Size group and grower number	Amount harvested			Costs		
	Total acres	Hundredweight equivalent		Total for season	Amount per acre	Amount per 100 lb. packed bag (cents)
		Total number	Number per acre			
			100 acres or more			
16	100	11,000	110	$ 3,291	$32.91	29.92
23	110	15,950	145	5,253	47.75	32.93
17	120	23,640	197	8,374	69.72	35.42
15	125	25,000	200	7,281	58.25	29.12
18	165	29,700	180	7,922	48.01	26.67
Total or average	620	105,290	170	$32,121	$51.80	30.51
All growers	1,388	231,718	167	$76,583	$55.18	33.05

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[a] Includes 91 acres of potatoes harvested with mechanical harvesters.

TABLE 9.--Costs of harvesting potatoes, according to operations hired on a custom basis, 23 growers who used mainly the conventional system, Firms 1 and 2, Hastings area, Florida, 1956[a]

Size group and grower number	Amount harvested			Costs		
	Total acres	Hundredweight equivalent		Total for season	Amount per acre	Amount per 100 lb. packed bag (cents)
		Total number	Number per acre			
			Hired all operations			
1	8	1,288	161	$ 458	$57.25	35.56
2	20	3,560	178	1,479	73.95	41.54
3	30	2,700	90	1,085	36.17	40.18
4	30	4,830	161	2,043	68.10	42.30
5	40	4,000	100	1,353	33.82	33.82
6	40	6,400	160	2,671	66.78	41.73
7	65	9,100	140	3,513	54.05	38.60
Total or average	233	31,878	137	$12,602	$54.08	39.53
			Hired rotobeating, pick up, and haul			
19	20	3,000	150	851	$42.55	28.36
20	60	11,220	187	4,238	70.63	37.77
21	35	4,550	130	1,778	50.80	39.08
22	40	6,000	150	2,186	54.65	36.43
23	110	15,950	145	5,253	47.75	32.93
Total or average	265	40,720	154	$14,306	$53.98	35.13

TABLE 9—Continued

Size group and grower number	Amount harvested			Costs		
	Total acres	Hundredweight equivalent		Total for season	Amount per acre	Amount per 100 lb. packed bag (cents)
		Total number	Number per acre			
				Hired pick up and haul only		
5	20	2,000	100	$ 948	$47.40	47.40
8	25	3,525	141	1,213	48.52	34.41
9	30	6,750	225	1,978	65.93	29.30
10	35	8,750	250	2,412	68.93	27.56
11	40	6,880	172	2,137	53.42	31.06
12	75	10,875	145	3,986	53.15	36.65
13	75	15,000	200	5,060	67.47	33.73
14	80	16,000	200	5,073	63.41	31.71
15	125	25,000	200	7,281	58.25	29.12
16	100	11,000	110	3,291	32.91	29.92
17	120	23,640	197	8,374	69.72	35.42
18	165	29,700	180	7,922	48.01	26.67
Total or average	890	159,120	178	$49,675	$55.81	31.22
All growers	1,388	231,718	167	$76,583	$55.18	33.05

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[a] Includes 91 acres of potatoes harvested with mechanical harvesters.

higher than that of the growers hiring rotobeating, picking-up, and hauling and 8.3 cents per bag higher than that of growers hiring only picking-up and hauling. The group hiring all of the operations had a lower yield per acre than either of the other groups.

Costs of Specific Harvesting Operations

To show the amount of the individual items of cost, data are presented for the 12 growers who hired only picking-up and hauling of potatoes. In these calculations, costs of harvesting the small acreage of potatoes with custom mechanical harvesters were excluded. The growers were divided into two size groups according to the acres of potatoes harvested, Table 10. The five growers with less than 50 acres of potatoes harvested an average of 30 acres per grower and had an average yield of 186 bags per acre. Growers with 50 acres or more harvested an average of 100 acres per grower and had a yield of 176 bags per acre. All growers averaged 71 acres each and a yield of 178 bags per acre.

TABLE 10.--Number of growers and volumes of potatoes harvested per grower, by acres harvested, 12 growers, Firms 1 and 2, Hastings area, Florida, 1956

Item	Acres of potatoes per grower		Average
	Less than 50	50 or more	All growers
Number of growers	5	7	12
Average acres per grower	30	100	71
Packed hundredweight per acre	186	176	178
Total number of packed hundredweight	5,531	17,545	12,560

Investment in and costs of operating rotobeaters and diggers.-- The average investment in rotobeaters was $545, Table 11. Investment of growers in the large size group was almost twice as great as that of growers in the small acreage group. Growers in both groups did some rotobeating on a custom basis for other growers.

Total annual cost of operating a rotobeater was $2.44 and $1.31 per acre for small and large size growers, respectively; average cost for all growers was $1.51 per acre. Depreciation and repair were the major cost items and averaged 98 cents and $1.03 per acre for small growers, and 55 and 41 cents for large growers. Depreciation averaged 63 cents and repair 52 cents per acre for all growers.

Investment in potato diggers averaged $864 for all growers, Table 12. The average investment of large growers was approximately $300 more than that of small growers. Some of the growers with small acreages used one-row diggers while those with larger acreages used two-row machines.

The cost of operating diggers was approximately $3.00 per acre, or 75 percent, higher for the growers with less than 50 acres than for those with 50 acres or more. Average cost for all growers was $4.71 per acre. Digger chains were the item of highest cost and amounted to $1.71 per acre for all growers. Depreciation and repair were other major cost items, averaging $1.13 and $1.17 per acre for the 12 growers. The cost of interest, insurance, and taxes was approximately one-half as high as depreciation and repair costs and averaged 93 cents per acre for growers with small acreages, 53 cents per acre for growers with large acreages, and 60 cents per acre for all growers.

TABLE 11.--Purchase price, annual use, and costs of operating rotobeaters, 12 growers, Hastings area, Florida, 1956

Item	Acres of potatoes per grower		Average all growers
	Less than 50	50 or more	
Purchase price and annual use			
Purchase price	$465	$842	$545
Annual use (acres)			
Total	65	122	105
On operator's farm	30	100	71
Total annual costs of operation			
Depreciation	$ 61	$ 62	$ 62
Interest, insurance, taxes	21	30	26
Repair	56	44	49
Miscellaneous	3	9	6
Total	$141	$145	$143
Annual costs of operation, operator's farm			
Depreciation	$ 29	$ 55	$ 44
Interest, insurance, taxes	11	28	21
Repair	31	41	37
Miscellaneous	2	7	5
Total	$ 73	$131	$107
Per acre costs of operation, operator's farm			
Depreciation	$ .98	$ .55	$ .63
Interest, insurance, taxes	.37	.28	.29
Repair	1.03	.41	.52
Miscellaneous	.06	.07	.07
Total	$2.44	$1.31	$1.51

TABLE 12.--Purchase price, annual use and costs of operating potato diggers, 12 growers, Hastings area, Florida, 1956

Item	Acres of potatoes per grower		Average all growers
	Less than 50	50 or more	
Purchase price and annual use			
Purchase price	$750	$1,068	$864
Annual use (acres)			
Total	59	114	91
On operator's farm	30	100	71
Total annual costs of operation			
Depreciation	$ 67	$ 99	$ 86
Interest, insurance, taxes	37	54	47
Digger chains	117	190	160
Repair	140	107	121
Miscellaneous	12	9	9
Total	373	459	423
Annual costs of operation, operator's farm			
Depreciation	$ 57	$ 96	$ 80
Interest, insurance, taxes	28	52	42
Digger chains	64	162	121
Repair	61	99	83
Miscellaneous	6	8	7
Total	$216	$ 417	$333
Per acre costs of operation, operator's farm			
Depreciation	$1.91	$ .96	$1.13
Interest, insurance, taxes	.93	.53	.60
Digger chains	2.13	1.62	1.71
Repair	2.03	.99	1,17
Miscellaneous	.21	.08	.10
Total	$7.21	$4.18	$4.71

Estimated costs of rotobeating potatoes.-- For all growers the average total cost of rotobeating potatoes was $2.41 per acre, or 1.35 cents per bag, Table 13. Cost of the rotobeater was the major item of cost and accounted for almost two-thirds of the total cost. Costs of the tractor driver and use of the tractor were about the same amount for all growers and for each size group. The small size group had a cost of rotobeating .5 cent per bag higher than that of the large size group due mainly to difference in cost of the rotobeater.

TABLE 13.--Estimated costs of rotobeating potatoes, 12 growers, Hastings area, Florida, 1956

Item	Rate paid	Amount per acre		Cost per 100 lb. packed bag (cents)
		Hours	Cost	
	Less than 50 acres			
Tractor driver	$ .84	.47	$ .40	.22
Use of tractor	.90	.47	.43	.23
Rotobeater			2.44	1.31
Total			$3.27	1.76
	50 acres and over			
Tractor driver	$1.01	.48	$ .49	.28
Use of tractor	.88	.48	.42	.24
Rotobeater			1.31	.74
Total			$2.22	1.26
	All growers			
Tractor driver	$ .98	.48	$ .48	.26
Use of tractor	.88	.48	.42	.24
Rotobeater			1.51	.85
Total			$2.41	1.35

Estimated costs of digging potatoes.-- The average cost of digging potatoes was $7.57 per acre, or 4.25 cents per bag, Table 14. Cost of operating the digger accounted for well over one-half of the total cost. Labor cost, most of which was for the tractor driver, averaged $1.70 per acre, or .96 cent per bag, and use of the tractor averaged $1.16 per acre, or .65 cent per bag. There was little difference between the size groups in costs of labor and use of tractor. Thus, the difference of 1.66 cents per bag in total cost between the size groups was largely due to the difference of 1.5 cents per bag in equipment cost of the digger.

TABLE 14.--Estimated costs of digging potatoes, 12 growers, Hastings area, Florida, 1956

Item	Rate paid	Amount per acre		Cost per 100 lb. packed bag (cents)
		Hours	Cost	
	Less than 50 acres			
Labor	$ .91	2.01	$ 1.82	.98
Use of tractor	.92	1.52	1.40	.75
Equipment cost			7.21	3.88
Total			$10.43	5.61
	50 acres and over			
Labor	$ .98	1.69	$ 1.67	.95
Use of tractor	.99	1.12	1.11	.63
Equipment cost			4.18	2.37
Total			$ 6.96	3.95
	All growers			
Labor	$ .97	1.75	$ 1.70	.96
Use of tractor	.97	1.19	1.16	.65
Equipment cost			4.71	2.64
Total			$ 7.57	4.25

Estimated costs of picking-up and hauling potatoes.-- As was mentioned previously, all growers hired their potatoes picked up and hauled to the packinghouse. The total cost of these items was allocated 54 percent to picking-up and 46 percent to hauling. Hauling cost was further divided equally between cost of labor and use of trucks.

The average cost of picking-up and hauling combined was $46.06 per acre, or 25.88 cents per bag, Table 15. Of these amounts, picking-up accounted for $23.94 per acre, or 13.45 cents per bag. Hauling amounted to 11.46 cents per bag and containers, sacks and baskets, accounted for the remainder. Growers in the large size group paid approximately three cents more per bag for picking-up and hauling than did growers in the small size group.[5] However, the cost of containers was over one cent per bag lower for the large size group.

Of the total cost of picking-up and hauling potatoes, $34.14 per acre, or about three-fourths, was labor cost. Labor alone used in picking-up accounted for slightly over one-half of the total cost.

Summary of total cost by operations.-- Of the total cost of 31.48 cents per bag of harvesting potatoes with the conventional system, almost 24 cents was cost of picking-up and hauling the potatoes, Table 16. Thus, these items accounted for almost 80 percent of the total cost. Cost of digging was a little more than 10 percent and that of rotobeating a little less than 5 percent of the total cost. Average cost was about the same for each of the size groups. Lower costs of rotobeating and digging of the large size group were more than offset by higher costs of picking-up and hauling potatoes.

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[5] Large growers may have to pay more for hauling potatoes than small growers because the distance hauled may be greater.

TABLE 15.--Estimated costs of picking-up and hauling potatoes, 12 growers, Hastings area, Florida, 1956

Item	Acres of potatoes per grower		Average all growers
	Less than 50	50 or more	
	Costs per acre (dollars)		
Picking-up	21.73	24.41	23.94
Hauling:			
Labor	9.26	10.40	10.20
Truck use	9.25	10.40	10.20
Total, hauling	18.51	20.80	20.40
Sacks and baskets	3.63	1.32	1.72
Total, all items	43.87	46.53	46.06
	Cost per 100 pounds packed (cents)		
Picking-up	11.68	13.87	13.45
Hauling:			
Labor	4.98	5.91	5.73
Truck use	4.97	5.91	5.73
Total, hauling	9.95	11.82	11.46
Sacks and baskets	1.95	.75	.97
Total, all items	23.58	26.44	25.88

TABLE 16.--Total estimated costs of harvesting potatoes with the conventional system, 12 growers, Hastings area, Florida, 1956

Item	Acres of potatoes per grower		Average all growers
	Less than 50	50 or more	
	Costs per acre (dollars)		
Rotobeat	3.27	2.22	2.41
Dig	10.43	6.96	7.57
Pickup	21.73	24.41	23.94
Haul	18.51	20.80	20.40
Sacks and baskets	3.63	1.32	1.72
Total	57.57	55.71	56.04
	Costs per 100 pounds packed (cents)		
Rotobeat	1.76	1.26	1.35
Dig	5.61	3.95	4.25
Pickup	11.68	13.87	13.45
Haul	9.95	11.82	11.46
Sacks and baskets	1.95	.75	.97
Total	30.95	31.65	31.48

Costs of Harvesting with One-Row Harvesters

Of the five growers interviewed who harvested their potatoes with one-row harvesters in 1956, one hired a neighbor to harvest and haul his entire crop of 40 acres on a custom basis. The grower paid 32 cents per packed bag for harvesting and hauling the potatoes to the packinghouse. In addition cost of field sacks amounted to about .67 cent per bag. The other four growers did their own harvesting but hired the potatoes hauled to the packing plant at a flat rate per bag. These growers harvested a total of 254 acres, or about 64 each. Average yield for all growers was 168 bags per acre. Since one grower operated two harvesters, an average of 51 acres was harvested per harvester.

Costs of Operating One-Row Harvesters

The average purchase price of one-row harvesters was $2,110, Table 17. Average estimated life of a harvester was 14 years. Based upon the data obtained from the operators and percentage of total use on the operator's farm, depreciation averaged $150 per year, or $2.96 per acre, and interest, insurance, and taxes $102 per year, or $2.02 per acre. Average repair cost, excluding digger chains, was $1.60 per acre and cost of digger chains amounted to $1.20 per acre. There was considerable variation among growers in the cost of the various items.

Costs of Harvesting

The total cost of harvesting with one-row harvesters was $44.10 per acre, or 26.47 cents per bag, Table 18. Of the total cost, 14.97 cents per bag, or almost 60 percent, was labor cost. The cost of labor used in hauling potatoes was 4.10 cents per bag, more than that of any other single item of labor. However, the cost of all labor used with the harvester amounted to nine cents per bag.

In harvesting potatoes with one-row harvesters only two separate operations, harvesting and hauling, are involved. Labor and equipment costs of hauling, including the cost of sacks, totaled 8.90 cents per bag. The remaining cost of 17.57 cents was for harvesting and included 3.73 cents for the tractor driver and use of the tractor. Thus, costs associated with the harvester amounted to 13.84 cents per bag, over half of the total harvesting cost.

It should be pointed out that these estimates are of costs incurred by the growers interviewed. The cost of depreciation and interest, insurance, and taxes would be higher for one-row harvesters purchased new. Purchase price of a one-row

TABLE 17.--Purchase price, estimated life, annual use, and estimated costs of specified items, one-row harvesters, 4 growers, Firms 1 and 2, Hastings area, Florida, 1956

Item	Grower number					Average per harvester[b]
	1	2	3	4[a]		
				A	B	
Purchase price, life and use:						
Purchase price	$2,000	$2,500	$3,000	$1,250	$1,800	$2,110
Expected life (years)	11	18	20	10	10	14
Annual use, total (acres)	54	58	50	50	50	53
Annual use, this farm (acres)	46	58	50	50	50	51
Annual costs, this farm:						
Depreciation	$155	$139	$150	$125	$180	$150
Interest, insurance, taxes	85	125	150	62	90	102
Repair	85	35	50	118	118	81
Digger chains	28	70	50	79	79	61
Miscellaneous	40	5	31	7	7	18
Total	$393	$374	$431	$391	$474	$412
Costs per acre:						
Depreciation	$3.37	$2.40	$3.00	$2.50	$ 3.60	$2.96
Interest, insurance, taxes	1.85	2.16	3.00	1.24	1.80	2.02
Repair	1.85	.60	1.00	2.36	2.36	1.60
Digger chains	.61	1.21	1.00	1.58	1.58	1.20
Miscellaneous	.87	.09	.62	.14	1.14	.35
Total	$8.55	$6.46	$8.62	$7.82	$10.48	$8.13

[a] This grower owned and operated two harvesters.

[b] Based on a total of five harvesters.

TABLE 18.--Costs of harvesting potatoes with one-row harvesters, 4 growers, Hastings area, Florida, 1956

Item	Rate paid	Amount per acre		Cost per 100 lb. packed bag (cents)
		Hours	Cost	
Labor:				
Drive tractor	$ .98	3.19	$ 3.13	1.87
Remove vines	.87	6.30	5.46	3.26
Sack potatoes	.98	6.38	6.27	3.73
Pick up potatoes	.89	3.79	3.37	2.01
Haul potatoes[a]			6.88	4.10
Total, labor			$25.11	14.97
Equipment:				
Tractor	$ .97	3.19	$ 3.10	1.86
Harvester			8.13	4.84
Trucks[a]			6.88	4.10
Sacks			1.18	.70
Total, equipment			$19.29	11.50
Total, all items			$44.40	26.47

[a] Hauling was hired performed on a custom basis.

harvester is currently about $3,600. Also, the growers interviewed may have been optimistic concerning the estimated life and thus the rate of depreciation of a one-row harvester. At least their estimates are high relative to that used for two-row harvesters in this study and to that of one-row harvesters used in a previous study. In his study, Spurlock used an estimated life of nine years.[6] At a purchase price of $3,600 and nine years estimated life, annual depreciation would be $400 and interest, insurance, and taxes $180. This would be a total of $580 annually for these items as compared to the $252 reported by the growers interviewed, or a difference of $328.

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[6] Spurlock, p. 147.

A change in purchase price and estimated life as indicated would increase the cost of operating one-row harvesters $6.43 per acre. At the yield of the growers interviewed this would amount to 3.83 cents per bag or would increase cost of harvesting potatoes with one-row machines from 26.47 cents to 30.30 cents per bag.

CHAPTER 5

ESTIMATED COSTS OF HARVESTING WITH CUSTOM MECHANICAL HARVESTING UNITS

Estimates were made of costs of mechanical harvesting and hauling the volume of potatoes packed in 1956 by each of the two plants studied. It was assumed that each firm would have had the necessary equipment and operated it on a custom basis for their patrons. To calculate costs, an estimate was made of the number of harvester hours that would have been required each day and each week to harvest the volumes of potatoes packed at each plant. On the basis of these data the number of different items of required equipment were determined and costs of harvesting with this equipment estimated.

Costs were also estimated for harvesting the volume of potatoes packed in 1956 at all packinghouses, except those at Bunnell, operated by each firm. The same procedure was used to estimate these costs as was used to estimate costs of harvesting and handling the potatoes packed at each plant.

Harvester Hours Required to Harvest 1956 Volume

As was stated in Chapter 3, in 1956, Plant A packed 131,838 bags during 38 days of operation and Plant B 63,578 bags in 29 days. In estimating the number of harvester hours that would have been required to harvest these volumes of potatoes, a yield of 160 bags per acre was assumed. This was approximately the average yield of the

23 growers included in the study who harvested their potatoes with the conventional system in 1956. Two rates of harvesting were assumed. These were .8 acre, 128 bags, and .94 acre, 150 bags, per hour of operation of each harvester. The lower rate was approximately the average reported by the five mechanical harvester operators interviewed in 1956.

While the rate of .94 acre per hour was not attained on the average by all growers who operated bulk harvesters in the area in 1956, it may be realistic under other harvesting conditions and will probably be realistic in the near future. Harvesting conditions were adverse in the 1956 season because of heavy rains. Also, improvements in equipment and additional experience of the operators should increase the average rate of harvesting. Actually, some growers have achieved the higher rate of harvesting in the past, at least for short periods of time.[1] One grower reported that he harvested as many as 13 acres in 11 hours and consistently harvested about 10 acres in 11 hours with each of two harvesters during the 1957 season.

Plant A

At a harvesting rate of 128 bags per hour, 1,030 harvester hours of operation would have been required to harvest the potatoes packed at Plant A in the 38 days it was operated in 1956, Table 19. The number of hours required would have ranged from 4 to 49 for individual days and from 16 to 228 for individual weeks. The smallest number of hours would have been required in the early part of the season and during two periods of heavy rainfall, April 23-28 and

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[1] Spurlock, p. 67.

TABLE 19.--Hours of harvester operation required to harvest potatoes packed on specified days and weeks, at harvesting rates of 128 and 150 packed hundredweight equivalent per hour per harvester, Plant A, Hastings area, Florida, 1956

Date	Total harvester hours required on:							Maximum hours any one day
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Total	
	128 packed hundredweight equivalent per hour per harvester							
April 2-7	...	...	...	...	...	16	16	16
April 9-14	26	22	30	39	33	5	155	39
April 16-21	13	29	41	36	32	...	151	41
April 23-28	22	27	12	12	24	20	117	27
April 30-May 5	33	47	49	43	49	7	228	49
May 7-12	4	9	16	28	37	8	102	37
May 14-19	32	31	41	45	49	14	212	49
May 21-22	25	24	...	...	...	...	49	25
Total	155	189	189	203	224	70	1,030	...
	150 packed hundredweight equivalent per hour per harvester							
April 2-7	...	...	...	...	...	14	14	14
April 9-14	22	18	25	34	27	4	130	34
April 16-21	11	24	35	30	27	...	127	35
April 23-28	19	23	10	10	21	17	100	23
April 30-May 5	28	40	42	37	42	6	195	42
May 7-12	4	7	14	24	32	7	88	32
May 14-19	27	27	35	39	42	12	182	42
May 21-22	22	20	...	...	...	...	42	22
Total	133	159	161	174	191	60	878	...

May 7-12.[2] During the week of maximum number of hours, April 30 to May 5, and omitting Saturday, the number of hours of harvester operation required daily would have ranged from 33 to 49 and averaged 44.

The pattern and variations in the number of harvester hours that would have been required at a harvesting rate of 150 bags per hour were similar to those needed at the lower rate. The 150 bag per hour rate is about 17 percent greater than the 128 bag rate, and the resulting decrease in number of required hours is approximately 14.5 percent. The higher rate of harvesting would have required only 878 hours of operation, or 152 less than that required at the lower rate. The differences in maximum number of hours at the two rates would have amounted to 33 and 7 for one week and one day, respectively.

Plant B

The number of harvester hours needed to supply Plant B with the volume of potatoes packed in 1956 would have been similar to the number required to supply Plant A in respect to variations within weeks, over the season, and for the different rates of harvesting. In total amount, less than 50 percent as many hours would have been required to harvest for Plant B as for Plant A. However, the maximum required at a harvesting rate of 128 bags per hour on any one day at Plant B would have been 40 hours, or about four-fifths of the 49 hours at Plant A, Table 20. For the peak week at Plant B, the total would have been 150 hours, or 66 percent of that at Plant A.

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[2] H. S. Stiles, Marketing Florida Potatoes, 1956 Season, United States Department of Agriculture, Agricultural Marketing Service and Florida State Marketing Bureau cooperating, Hastings, Florida, May 1956, pp. 2 and 3.

TABLE 20.--Hours of harvester operation required to harvest potatoes packed on specified days and weeks, at harvesting rates of 128 and 150 packed hundredweight equivalent per hour per harvester, Plant B, Hastings area, Florida, 1956

Date	Total harvester hours required on:							Maximum hours any one day
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Total	
	128 packed hundredweight equivalent per hour per harvester							
April 30-May 5	14	25	27	19	18	2	105	27
May 7-12	9	8	...	20	34	16	87	34
May 14-19	22	36	40	25	27	...	150	40
May 21-26	24	28	22	31	23	1	129	31
May 28-June 2	10	14	2	...	...	...	26	14
Total	79	111	91	95	102	19	497	...
	150 packed hundredweight equivalent per hour per harvester							
April 30-May 5	12	21	23	16	15	1	88	23
May 7-12	7	7	...	17	29	14	74	29
May 14-19	19	31	35	22	23	...	130	35
May 21-26	21	24	19	27	19	1	111	27
May 28-June 2	9	12	1	...	...	...	22	12
Total	68	95	78	82	86	16	425	...

Amount and Cost of Equipment Required

The Custom Harvesting Unit

As used in this study the term "custom harvesting unit" includes all equipment and labor required to dig and haul potatoes to the relevant packinghouses under stated assumptions. Items of equipment necessary are tractors, two-row mechanical harvesters, trucks, bulk bodies, and electric motors used to unload the bulk trucks at the packinghouse.

The number of tractors and harvesters necessary to supply a particular plant with potatoes depends on the volume packed, the rate of harvesting, and of course the number of hours per day that the harvesters are operated. The number of trucks and bulk bodies needed depends upon the rate of harvesting, distance the potatoes have to be hauled, and time required to unload trucks at the packinghouse. Generally, from three to four trucks are considered by harvester operators to be sufficient to haul potatoes from one harvester. However, enough trucks were included in the hypothetical custom harvesting units to enable each truck to haul about the same volume of potatoes per hour of operation. In order to prevent excessive delay of the trucks, four motors are needed to unload the trucks at the packinghouse.

Method of Estimating Amount and Cost of Equipment

In estimating the number of different items of equipment that would have been required in each custom harvesting unit, various assumptions were made. These assumptions specify conditions under which it seemed that the units would or could have been operated if the firms had performed the harvesting operation. Assumptions as to yield per acre and rate of harvesting have been given. It was considered desirable to estimate the amounts of equipment that would have been required to harvest each day the same volume of potatoes that the relevant plant packed in 1956. However, volumes packed daily within a given week varied greatly in 1956 and do each season. Thus, less equipment might have been needed if the daily volumes harvested each week could have been evened out. Therefore, the size of the custom harvesting units was also calculated under the assumption that volume harvested each week, but not necessarily each day of the week, was the same as those packed in 1956.

The maximum number of required hours of operation for one day or one week, as the case might be, and the number of hours a day that a harvester could be operated determined the number of harvesters and tractors required to harvest the potatoes packed by the plant. Since most mechanical harvester operators in the area operate their equipment for about nine hours a day, this number was used as a guide. However, a certain amount of judgment also was used in deciding just how many harvesters would have been needed. For example, suppose the maximum number of harvester hours required for any day of the season was 22 for a unit set up to harvest the volume of potatoes packed daily by a plant. In such a case, if the number of required hours were low on days preceding and following the maximum, two harvesters would have been considered adequate. On the other hand, if the required number of hours were also high on days preceding and following the maximum, three harvesters would have been included in the harvesting unit.

Retail prices of the equipment, delivered to the area, in 1957 were obtained from dealers in potato harvesting equipment and were used to estimate the cost of the equipment included in the custom harvesting units. It should be pointed out that mechanically harvested potatoes are often hired hauled on a custom basis in the Hastings area. While the per unit cost is likely about the same regardless of who performs the hauling operation, the amount of investment required is different. When hauling is done on a custom basis, the custom operator furnishes the truck but not the bulk body. Thus, if hauling had been hired, the total investment in the harvesting units would have decreased by the amount of the purchase price of the trucks included in the unit. In addition to custom hauling, it might have been possible for the firms to have also rented tractors rather than owned them.

Total Amount and Cost of Equipment Required For Individual Plants

The amount and cost of equipment in the custom units that would have been required to harvest the potatoes packed at each of the two packinghouses in 1956 were estimated for each of the four combinations of assumptions relating to rate of harvesting and pattern of harvesting during the week. Thus, estimates were made for four custom harvesting units for each plant.

Plant A.-- At a harvesting rate of 128 bags per hour, five tractors and harvesters, 16 trucks and bulk bodies, and four electric motors would have been required to harvest the volumes of potatoes packed daily at Plant A, Table 21. Total cost of this equipment would have been $99,460 with trucks accounting for almost a half and harvesters almost a third of this amount. At the same rate of

TABLE 21.--Amount and cost of equipment required to harvest daily and weekly volumes of potatoes packed in 1956, at harvesting rates of 128 and 150 packed hundredweight equivalent per hour per harvester, Plant A, Hastings area, Florida

Item	Price, each	Daily volumes same as 1956		Weekly volumes same as 1956	
		Number of items	Total cost	Number of items	Total cost
128 hundredweight equivalent per hour per harvester					
Tractors	$3,000	5	$15,000	4	$12,000
Harvesters	5,800	5	29,000	4	23,200
Trucks	2,900	16	46,400	13	37,700
Bulk bodies	550	16	8,800	13	7,150
Motors	65	4	260	4	260
All items	.....	...	$99,460	...	$80,310
150 hundredweight equivalent per hour per harvester					
Tractors	$3,000	4	$12,000	4	$12,000
Harvesters	5,800	4	23,200	4	23,200
Trucks	2,900	15	43,500	15	43,500
Bulk bodies	550	15	7,150	15	7,150
Motors	65	4	260	4	260
All items	.....	...	$86,110	...	$86,110

harvesting, one less tractor and harvester and three fewer trucks and bodies would have been required if volumes harvested were those packed weekly instead of daily. Total equipment cost would thus have been reduced by about $19,000.

Four tractors and harvesters would also have been required at a harvesting rate of 150 bags per hour, regardless of the pattern of harvesting during the week. However, these units would have required 15 trucks and bulk bodies, two more than required at the lower harvesting rate when volumes harvested were those packed weekly. Total equipment cost would have been $86,110.

Plant B.-- Each of the four custom harvesting units needed for Plant B would have included three tractors and harvesters, Table 22. Both units required at the harvesting rate of 128 bags per hour would have included 10 trucks and bodies, while 11 trucks and bodies would have been needed at a harvesting rate of 150 bags per hour. The equipment cost at the higher rate of harvesting would have been approximately $3,500, or five percent, more than that required at the lower rate.

The total equipment cost of the custom harvesting units for Plant B would have been about two-thirds to three-fourths of those required for Plant A, depending upon the particular harvesting units compared. However, it should be recalled that

TABLE 22.--Amount and cost of equipment required to harvest daily and weekly volumes of potatoes packed in 1956, at harvesting rates of 128 and 150 packed hundredweight equivalent per hour per harvester, Plant B, Hastings area, Florida[a]

Item	Price, per unit	128 hundredweight per hour		150 hundredweight per hour	
		Number of units	Total cost	Number of units	Total cost
Tractors	$3,000	3	$ 9,000	3	$ 9,000
Harvesters	5,800	3	17,400	3	17,400
Trucks	2,900	10	29,000	11	31,900
Bulk bodies	550	10	5,500	11	6,050
Motors	65	4	260	4	260
All items	.....	...	$61,160	...	$64,610

[a] The same amount of equipment would have been required regardless of pattern of harvesting within a week.

the total harvester hours of operation required and the total volume of potatoes packed by Plant B were less than half those of Plant A.

Costs of Operating Equipment and Harvesting Potatoes

Method of Estimating and Presenting Costs

All costs were based upon information obtained from harvester operators, equipment dealers, and previous research. Generally, cost estimates used were a synthesization of estimates obtained from these sources. Annual costs of depreciation and of interest, insurance, and taxes per unit on specific items of equipment are shown in Table 23. The straight line depreciation method was used and amount of depreciation was based on the prices and expected life of the equipment. Interest, insurance, and taxes were calculated at 3, 1, and 1 percent, respectively, of the purchase price.

TABLE 23.--Estimated purchase price, expected life, and annual cost of depreciation and of interest, insurance, and taxes of one unit of each item of equipment used in mechanical harvesting and bulk handling of potatoes, Hastings area, Florida

Item	Estimated purchase price	Estimated life (years)	Annual cost		
			Depreciation	Interest, insurance, taxes, at 5% of purchase price	Total
Tractor	$3,000	15	$1,200	$150	$1,350
Two-row harvester	5,800	5	1,160	290	1,450
Truck	2,900	10	290	145	435
Bulk body	550	10	55	28	83
Motor	65	15	4	3	7

The prices of the harvester and bulk body are for a particular make. This make was chosen because it is used more than any other by farmers in the area. Other makes and models of harvesters vary in price from less than the $5,800 for the one used to as much as $7,700. Price of a bulk body runs as high as $750.

The bases for estimating other costs of the harvesting units are given in Table 24. In addition to the usual expenses, an allowance was made for a skilled repairman. If a number of harvesters are to be operated simultaneously and efficiently it is necessary that breakdowns be repaired as quickly as possible. Expense of hiring a mechanic for such a job was estimated at $150 per week. This amount would pay for salary only. Additional amounts were allocated for the purchase of repair parts.

Costs of harvesting with the custom harvesting units are presented for each firm separately. They are presented for only two harvesting units for Plant A and only one for Plant B. The amount of equipment and costs of harvesting for Plant A at a rate of 150 bags per hour would be the same regardless of whether the units would have harvested daily or weekly volumes packed in 1956. Also, the total cost at this rate would be little different from that of harvesting at the rate of 128 bags per hour the volumes packed weekly in 1956. Therefore, the costs of the units set up to harvest for Plant A at a rate of 150 bags per hour are not presented but are included in appendix tables and referred to in the text.

It will be recalled that custom units that would have been required to harvest the daily and weekly volumes of potatoes packed by Plant B were identical. The only difference in the custom units needed at different harvesting rates was that

TABLE 24.--Estimated price per unit, amounts used, and cost for specified periods for operating individual items of equipment used in custom mechanical harvesting units, Hastings area, Florida

Item	Unit	Price per unit	Period or amount of use	Number of units used in period	Cost during period of use
Tractor:					
Fuel	gallon	$ .17	1 hour	1.5	$ 0.255
Oil	quarts	.25	60 hours	8	2.00
Filter	filter	1.50	60 hours	1	1.50
Grease	pound	.15	season	.5	.75
Repair	...	...	season	...	160.00
Service labor	man hour	1.00	1 day	.25	.25
Driver	man hour	1.00	1 hour	1	1.00
Harvester:					
Labor:[a]					
Operator	man hour	1.00	1 hour	1	1.00
Pick vines	man hour	.70	1 hour	2	1.40
Pick up potatoes	man hour	.70	1 hour	1	.70
Service	man hour	1.00	1 day	.25	.25
Chains	set	100.00	100 acres	1	100.00
Repair parts	...	...	1 acre	1	2.25
Grease and oil	pound	.15	season	10	1.50
Trucks:					
Fuel	gallon	.30	1 acre	2.5	.75
Oil	quart	.25	200 acres	24	6.00
License	...	29.00	season	1	29.00
Insurance	policy	14.00	season	1	14.00
Grease	pound	.15	season	5	.75
Labor (driver)	man hour	1.00	1 hour	1	1.00
Repair	...	...	season	...	100.00

[a] In addition to the usual costs an allowance was made for the services of one repairman for each four or five harvesters. The estimated wage for this man was $150.00 per week.

the unit for the higher rate required one more truck and body to haul the potatoes. The addition of only one truck makes a difference of less than one cent per bag in total harvesting cost. Therefore, costs of harvesting are presented for just one of the custom units set up for Plant B.

Harvesting costs are presented for tractors, harvesters, and hauling and by fixed and operating costs. They are broken down by cost items. Comparisons are made of costs of harvesting at different harvesting rates, with different volumes harvested daily, and for different plants.

Costs of Harvesting Potatoes Packed at Individual Plants

Plant A.-- At harvesting rates of 128 and 150 bags per hour per harvester, 1,030 and 878 harvester hours, respectively would have been required to harvest the potatoes packed by Plant A. At a harvesting rate of 128 bags per hour, the estimated total cost of custom mechanical harvesting the potatoes packed daily at Plant A in 1956 would have been $39.79 per acre, Table 25.[3] This cost is $4.73 per acre, three cents per bag, higher than that of the harvesting unit that would have been required if volumes harvested were those packed weekly.

Tractor costs amounted to a very small proportion, about one-eighth, of the total cost of each unit. Costs of the harvester and of hauling accounted for the major portion of the total cost and were about equal in amount. Harvester cost was 10.79 and 9.69 cents per bag and hauling cost was 11.09 and 9.62 cents per bag for the units required to harvest daily and weekly volumes, respectively. Costs of

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[3] See Table 55 for costs of harvesting with the custom harvesting unit required at a harvesting rate of 150 bags per hour per harvester.

TABLE 25.--Estimated costs of harvesting with custom mechanical harvesting units, operated at a harvesting rate of 128 packed hundredweight equivalent per hour per harvester, the volumes of potatoes packed daily and weekly at Plant A in 1956, Hastings area, Florida[a]

Items	Estimated costs for a rate of harvesting same as daily rates in 1956			Estimated costs for a rate of harvesting same as weekly but not daily rates in 1956		
	Total cost per season	Cost per		Total cost per season	Cost per	
		Acre	Pk. cwt. (cents)		Acre	Pk. cwt. (cents)
Tractor:						
Depreciation, interest, insurance, taxes	$ 1,750	$ 2.12	1.33	$ 1,400	$ 1.70	1.06
Repair	800	.97	.61	640	.78	.48
Fuel	263	.32	.20	263	.32	.20
Driver	1,030	1.25	.78	1,030	1.25	.78
Miscellaneous	111	.13	.08	100	.12	.08
Total	$ 3,954	$ 4.79	3.00	$ 3,433	$ 4.17	2.60
Harvester:						
Depreciation, interest, insurance, taxes	$ 7,250	$ 8.80	5.50	$ 5,800	$ 7.04	4.40
Repair parts	1,854	2.25	1.41	1,854	2.25	1.41
Digger chains	824	1.00	.62	824	1.00	.62
Repairman, labor	1,050	1.27	.80	1,050	1.27	.80
Labor on harvester	3,193	3.87	2.42	3,193	3.87	2.42
Miscellaneous	55	.07	.04	55	.07	.04
Total	$14,226	$17.26	10.79	$12,776	$15.50	9.69
Hauling:						
Trucks and bodies:						
Depreciation, interest, insurance, taxes	$ 8,288	$10.06	6.29	$ 6,734	$ 8.17	5.11
Repair	1,600	1.94	1.21	1,300	1.58	.99
License	464	.56	.35	377	.46	.28
Liability insurance	224	.27	.17	182	.22	.14
Drivers	3,296	4.00	2.50	3,354	4.07	2.54
Fuel	618	.75	.47	618	.75	.47
Miscellaneous	108	.13	.08	88	.11	.07
Motors	28	.03	.02	28	.03	.02
Total	$14,626	$17.74	11.09	$12,681	$15.39	9.62
Total, all items	$32,806	$39.79	24.88	$28,890	$35.06	21.91

[a] See Table 55 for costs of harvesting at a rate of 150 packed hundredweight equivalent per hour per harvester.

depreciation, interest, insurance, and taxes were by far greater than that of any other item of costs in operating the harvester or in hauling potatoes. They accounted for well over half of the total harvester and hauling costs of the unit required to harvest volumes packed daily, and approximately half of these costs of the unit required to harvest volumes packed weekly. Repair parts and labor were other major items of harvesting and hauling costs.

Fixed cost items accounted for $26.02, or 65 percent, of the total cost of $39.79 per acre of harvesting with the unit required to harvest the volume of potatoes packed daily in 1956, Table 26. With the unit that would have been required to harvest the same volumes packed weekly but not daily, fixed costs were 60 percent of the total of $35.06 an acre. Depreciation, interest, insurance, and taxes accounted for about three-fourths and four-fifths of the fixed costs of the units needed to harvest the volumes packed daily and weekly, respectively. Only two other fixed cost items, repair of trucks and labor of the repairman, accounted for as much as $1.00 per acre for either unit.

Cost of labor amounted to approximately $9.00 per acre, or 5.70 cents per bag for both harvesting units. This was about two-thirds of all variable costs. Repair parts for the harvester, the only other variable cost item that amounted to over $1.00 per acre, were $2.25 per acre, or 16 percent of total variable costs. Cost of labor used in hauling potatoes and that used on the harvester were about 44 and 42 percent, respectively, of total labor cost. The cost of tractor drivers accounted for the remaining 14 percent.

Plant B.-- At harvesting rates of 128 and 150 bags per harvester hour, 497

TABLE 26.--Estimated fixed and variable costs of harvesting with custom mechanical harvesting units, operated at a harvesting rate of 128 packed hundredweight equivalent per hour per harvester, the volumes of potatoes packed daily and weekly at Plant A in 1956, Hastings area, Florida

Item	Estimated costs for rates of harvesting same as daily rates in 1956			Estimated costs for rates of harvesting same as weekly but not daily rates in 1956		
	Total cost per season	Cost per		Total cost per season	Cost per	
		Acre	Pk.cwt. (cents)		Acre	Pk.cwt. (cents)
Fixed costs:						
Tractor[a]	$ 1,750	$ 2.12	1.33	$ 1,400	$ 1.70	1.06
Harvester[a]	7,250	8.80	5.50	5,800	7.04	4.40
Trucks and bodies[a]	8,288	10.06	6.29	6,734	8.17	5.11
Labor, repairman	1,050	1.27	.80	1,050	1.27	.80
Repair, tractor	800	.97	.61	640	.78	.48
Repair, trucks	1,600	1.94	1.21	1,300	1.58	.99
License, trucks	464	.56	.35	377	.46	.28
Liability insurance, trucks	224	.27	.17	182	.22	.14
Motors	28	.03	.02	28	.03	.02
Total	$21,454	$26.02	16.28	$17,511	$21.25	13.28
Variable costs:						
Driver, hauling	$ 3,296	$ 4.00	2.50	$ 3,354	$ 4.07	2.54
Labor, harvester	3,193	3.87	2.42	3,193	3.87	2.42
Driver, tractor	1,030	1.25	.78	1,030	1.25	.78
Repair parts, harvester	1,854	2.25	1.41	1,854	2.25	1.41
Digger chains	824	1.00	.62	824	1.00	.62
Fuel, truck	618	.75	.47	618	.75	.47
Fuel, tractor	263	.32	.20	263	.32	.20
Miscellaneous, all	274	.33	.20	243	.30	.19
Total	$11,352	$13.77	8.60	$11,379	$13.81	8.63
Total, all items	$32,806	$39.79	24.88	$28,890	$35.06	21.91

[a] Includes depreciation, interest, insurance, and taxes.

and 425 harvester hours, respectively, would have been required to harvest the potatoes packed at Plant B. Estimated cost of harvesting the volumes of potatoes packed daily in 1956 when rate of harvesting was assumed to be 128 bags per hour was $46.71 per acre, or 29.17 cents per bag, Table 27.[4] Costs of operating the tractors and harvesters and of hauling the potatoes were 3.45, 12.55, and 13.77 cents per bag or 12, 43, and 45 percent, respectively, of the total harvesting cost. Hence, the relative magnitude of these costs was about like that of Plant A. Similarly, the relationship among specific cost items was generally the same as that of the harvesting units for Plant A except that fixed cost items comprised a larger proportion of total harvesting cost. For Plant B fixed cost items amounted to 72 percent of the total harvesting cost, Table 28.

The differences in the magnitude of total costs and relationships between fixed and variable costs of harvesting with the custom harvesting units of Plants A and B, of course, would be due to the difference in amount of use per item of equipment included in the units. Each harvester and truck of the harvesting unit required to harvest weekly volumes of potatoes packed at Plant A in 1956 would have harvested and hauled 206 acres or 10,141 bags of potatoes, respectively; those of the unit for Plant B would have harvested and hauled only 132 acres or 6,358 bags of potatoes each, Table 29. The annual use per harvester and per truck of the Plant B unit would have amounted to only about 63 percent of the use of those in the Plant A unit.

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[4] Estimated costs of harvesting daily and weekly volumes packed in 1956 were identical. See Table 56 for costs of harvesting when assumed harvesting rate was 150 bags per hour.

TABLE 27.--Estimated costs of harvesting with custom mechanical harvesting units, operated at a harvesting rate of 128 packed hundredweight equivalent per hour per harvester, the volumes of potatoes packed daily at Plant B in 1956, Hastings area, Florida

Item	Cost for season	Cost per:	
		Acre	Packed cwt. (cents)
Tractor:			
Depreciation, interest, insurance, taxes	$ 1,050	$ 2.64	1.65
Repair	480	1.21	.75
Fuel	127	.32	.20
Driver	497	1.25	.78
Miscellaneous	47	.12	.07
Total	$ 2,201	$ 5.54	3.45
Harvester:			
Depreciation, interest, insurance, taxes	$ 4,350	$10.96	6.84
Repair parts	893	2.25	1.41
Digger chains	397	1.00	.62
Repairman, labor	750	1.89	1.18
Labor on harvester	1,541	3.87	2.42
Miscellaneous	52	.13	.08
Total	$ 7,983	$20.10	12.55
Hauling:			
Trucks and bodies:			
Depreciation, interest, insurance, taxes	$ 5,180	$13.05	8.15
Repair	1,000	2.52	1.57
License	290	.73	.46
Liability insurance	140	.35	.22
Drivers	1,320	3.32	2.08
Fuel	298	.75	.47
Miscellaneous	68	.17	.11
Motors	70	.18	.11
Total	$ 8,366	$21.07	13.17
Total, all items	$18,550	$46.71	29.17

[a] Costs of the unit required to maintain the daily pattern and that required to maintain the weekly pattern of volumes packed in 1956 would have been identical.

TABLE 28.--Estimated fixed and variable costs of harvesting with a custom mechanical harvesting unit, operated at a rate of 128 packed hundredweight equivalent per hour per harvester, the volumes of potatoes packed daily at Plant B in 1956, Hastings area, Florida[a]

Item	Cost for season	Cost per:	
		Acre	Packed cwt. (cents)
Fixed costs:			
Tractors[b]	$ 1,050	$ 2.64	1.65
Harvester[b]	4,350	10.96	6.84
Trucks and bodies[b]	5,180	13.05	8.15
Labor, repairman	750	1.89	1.18
Repair, tractor	480	1.21	.75
Repair, trucks	1,000	2.52	1.57
License, trucks	290	.73	.46
Liability insurance, trucks	140	.35	.22
Motors[b]	70	.18	.11
Total	$13,310	$33.53	20.93
Variable costs:			
Driver, hauling	$ 1,320	$ 3.32	2.08
Labor, harvester	1,541	3.87	2.42
Driver, tractor	497	1.25	.78
Repair parts, harvester	893	2.25	1.41
Digger chains	397	1.00	.62
Fuel, truck	298	.75	.47
Fuel, tractor	127	.32	.20
Miscellaneous, all	167	.42	.26
Total	$ 5,240	$13.18	8.24
Total, all items	$18,550	$46.71	29.17

[a] Costs of the unit required to maintain the daily pattern and that required to maintain the weekly pattern of volumes packed in 1956 would have been identical.

[b] Includes depreciation, interest, insurance, and taxes.

TABLE 29.--Estimated annual use of harvesters and trucks to harvest potatoes packed in 1956 at PlantsA and B, Hastings area, Florida

Item	128 packed hundredweight equivalent per hour per harvester		
	Plant A		Plant B
	Daily volume equal 1956	Weekly volume equal 1956	Daily or weekly volume equal 1956
Estimated acres harvested:			
Total	824	824	397
Per harvester	165	206	132
Hours per harvester	206	258	166
Maximum harvester hours required any one day	49	44	40
Bags of potatoes per truck	8,240	10,141	6,358

Costs of Harvesting Potatoes Packed at All Plants of Each Firm

Since much larger volumes of potatoes were packed by all plants than were packed by any one plant of the firms and since time of harvesting varied among localities in the area, it appeared that greater annual use and lower per unit costs of the mechanical harvesting equipment might be attained if the custom harvesting operation were performed for patrons of all plants rather than just for those of a single plant. Hence, custom harvesting units were set up, amounts of required equipment and investment estimated, and costs of harvesting with these units calculated for each firm. The estimates were made in the same manner as those for the individual plants with one exception. In setting up the harvesting units for the firm, a repairman was included in each custom harvesting unit for every four harvesters.

The four plants of Firm 1 packed 347,821 bags of potatoes in 1956, Table 57 in the appendix. At a yield of 160 bags per acre this would be 2,174 acres. The three plants of Firm 2 packed only 219,691 bags, or 1,373 acres. As in the case of individual plants, the volumes packed daily and weekly varied widely over the season.

Number of Hours of Harvester Operation Required

Firm 1.-- The hours of harvester operation required per day, at a rate of 128 bags per hour, to harvest the potatoes packed daily by Firm 1 would have ranged from a low of four to a high of 126, Table 30. The number required during the peak week of harvesting would have been 611. Harvesting at a rate of 150 bags per hour would have reduced the maximum number of hours for any one day and week of the season to 108 and 522, respectively.

Firm 2.--The harvester hours required daily, at a harvesting rate of 128 bags per hour, to harvest potatoes packed by Firm 2 would have ranged from 2 to 104, Table 31. The total for the week of maximum volume would have been 420 hours. The maximum number of hours required for one day and for one week would have been reduced to 89 and 359, respectively, if rate of harvesting had been 150 bags per hour.

Amount and Cost of Equipment

The amount and cost of equipment required to harvest and handle potatoes, at a rate of 128 bags per hour, are presented only for the harvesting units required to harvest volumes packed weekly by the firms in 1956. Under the assumptions stated, the harvesting unit for Firm 1 would have required 11 tractors and harvesters, TABLE 30.--Hours of harvester operation required to harvest potatoes packed on specified days and weeks, at harvesting rates of 128 and 150 packed hundredweight equivalent per hour per harvester, Firm 1, Hastings area, Florida, 1956

Date	Total harvester hours required on:						Total	Maximum, any one day
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday		
			128 packed hundredweight equivalent per hour per harvester					
March 22-24	...	...	...	4	7	5	16	7
March 26-31	5	9	14	18	15	6	67	18
April 2-7	8	13	19	24	24	16	104	24
April 9-14	26	21	30	43	43	8	171	43
April 16-21	30	37	48	50	44	4	213	50
April 23-28	49	61	14	23	82	64	293	64
April 30-May 5	92	106	102	114	110	40	564	114
May 7-12	26	53	64	98	73	61	375	98
May 14-19	95	115	111	111	126	53	611	115
May 21-26	86	97	69	10	30	...	292	97
May 28-30	...	4	5	...	...	...	9	5
Total	417	516	476	495	554	257	2,715	...
			150 packed hundredweight equivalent per hour per harvester					
March 22-24	...	...	...	3	6	5	14	6
March 26-31	5	7	12	16	13	5	58	16
April 2-7	7	11	16	20	20	14	88	20
April 9-14	22	18	25	37	37	7	146	37
April 16-21	26	31	41	43	38	4	183	43
April 23-28	42	52	12	19	70	54	249	70
April 30-May 5	79	91	87	98	94	34	483	98
May 7-12	22	45	55	83	62	52	319	83
May 14-19	81	98	95	95	108	45	522	108
May 21-26	73	83	59	9	26	...	250	83
May 28-30	...	3	4	...	...	...	7	...
Total	357	439	406	423	474	220	2,319	...

TABLE 31.--Hours of harvester operation required to harvest potatoes packed on specified days and weeks, at harvesting rates of 128 and 150 packed hundredweight equivalent per hour per harvester, Firm 2, Hastings area, Florida, 1956

Date	Total harvester hours required on:						Total	Maximum, any one day
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday		
	128 packed hundredweight equivalent per hour per harvester							
March 26-31	...	...	9	6	3	2	20	9
April 2-7	...	10	3	5	3	7	28	10
April 9-14	4	4	4	9	13	...	34	13
April 16-21	6	19	25	22	29	15	116	29
April 23-28	10	11	13	3	20	24	81	24
April 30-May 5	41	80	83	62	51	3	320	83
May 7-12	21	21	23	69	89	53	276	89
May 14-19	67	92	104	79	71	7	420	104
May 21-26	67	93	64	91	60	16	391	93
May 28-June 3	11	13	2	...	...	...	26	13
Total	227	343	330	346	339	127	1,712	...
	150 packed hundredweight equivalent per hour per harvester							
March 26-31	...	...	7	5	3	2	17	7
April 2-7	...	8	3	4	2	6	23	8
April 9-14	3	4	3	8	11	...	29	11
April 16-21	5	16	21	19	25	13	99	25
April 23-28	8	9	11	3	17	21	69	21
April 30-May 5	35	68	71	53	44	3	274	71
May 7-12	18	18	19	58	77	46	236	77
May 14-19	57	79	89	68	60	6	359	89
May 21-26	58	79	55	77	51	14	334	79
May 28-June 3	9	12	1	...	...	...	22	12
Total	193	293	280	295	290	111	1,462	...

35 trucks and bodies, and 16 electric motors, Table 32. Total cost of this equipment would have been $218,590. For Firm 2 equipment needed would have been eight tractors and harvesters, 26 trucks and bodies, and 12 motors. Total investment would have been $160,880, less than 80 percent of that for Firm 1. Harvesters of the units for Firms 1 and 2, respectively, would have harvested 198 and 172 acres each.

At a rate of 128 bags per hour, harvesting the amounts packed daily by Firms 1 and 2 would have required 15 and 10 harvesters, respectively. Those for Firm 1 would have harvested only 145 acres and those for Firm 2, 137 acres each. A harvesting rate of 150 bags per hour would have required 12 harvesters to harvest potatoes packed daily and 10 to harvest those packed weekly by Firm 1. Corresponding numbers of harvesters for Firm 2 would have been nine and eight. None of these harvesting units would have permitted a greater annual use of equipment than the units set up for the firms' individual plants, so it was not considered necessary to present equipment and cost data for these units.

TABLE 32.—Amount and cost of equipment required to harvest with mechanical harvesting units, operated at a harvesting rate of 128 packed hundredweight equivalent per hour per harvester, the volumes of potatoes packed weekly in 1956, Firms 1 and 2, Hastings area, Florida

Item	Firm 1		Firm 2	
	Number of items	Total cost all items	Number of items	Total cost all items
Tractors	11	$ 33,000	8	$ 24,000
Harvesters	11	63,800	8	46,400
Trucks	35	101,500	26	75,400
Bulk bodies	35	19,250	26	14,300
Motors	16	1,040	12	780
All items	...	$218,590	...	$160,880

Costs of Harvesting Potatoes Packed by Firms 1 and 2

Under the assumptions made as to rate and pattern of harvesting, estimated total cost of harvesting the potatoes packed by Firm 1 would have been $36.18 per acre, or 22.60 cents per bag, Table 33. Corresponding costs for Firm 2 would have been $40.01 per acre, or 24.99 cents per bag. The relative magnitudes of specific cost items are about the same for these firms as for the individual plants discussed earlier. Of course, the smaller the amount of annual use per harvester and truck, the higher the fixed costs relative to variable costs per unit of potatoes harvested.

The estimated cost of harvesting potatoes packed by Firm 1 was about one cent per bag more than was the cost of harvesting with the corresponding unit for Plant A of Firm 1. The estimated cost for Firm 2, however, was about five cents per bag less than that for the harvesting unit for Plant B. Costs of harvesting potatoes packed at all houses of a firm would likely be lower than that of harvesting for an individual plant if the plant was in operation for only a short period of time; it would likely be no lower and might be higher than the cost of harvesting potatoes packed by a single plant if the plant operated for a relatively long period of time during the season. The determining factor, of course, would be the amount of annual use of each harvester and truck in the harvesting unit.

Had the houses at Bunnell been included, costs of harvesting potatoes packed by all houses of each firm would likely have been little different than those presented above. In 1956 the peak of the harvesting season in the Bunnell section occurred about the same time as that of other sections of the area.[5] Thus, had equipment been

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[5] Florida Crop and Livestock Reporting Service, Potato Report, 1952-56.

TABLE 33.--Estimated costs of harvesting with custom mechanical harvesting units, operated at a rate of 128 packed hundredweight equivalent per hour per harvester, the volumes of potatoes packed weekly in 1956, Firms 1 and 2, Hastings area, Florida

Item	Firm 1			Firm 2		
	Cost season	Cost per		Cost season	Cost per	
		Acre	Packed cwt. (cents)		Acre	Packed cwt. (cents)
Tractor:						
Depreciation, interest insurance, taxes	$ 3,850	$ 1.77	1.11	$ 2,800	$ 2.04	1.27
Repair	1,760	.81	.51	1,280	.93	.58
Fuel	693	.32	.20	438	.32	.20
Driver	2,717	1.25	.78	1,716	1.25	.78
Miscellaneous	288	.13	.08	194	.14	.09
Total	$ 9,308	$ 4.28	2.68	$ 6,428	$ 4.68	2.92
Harvester:						
Depreciation, interest, insurance, taxes	$15,950	$ 7.34	4.58	$11,600	$ 8.45	5.28
Repair parts	4,892	2.25	1.41	3,089	2.25	1.41
Digger chains	2,174	1.00	.62	1,373	1.00	.62
Repairman, labor	4,050	1.86	1.16	3,000	2.18	1.37
Labor on harvester	8,423	3.87	2.42	5,320	3.87	2.42
Miscellaneous	148	.07	.04	108	.08	.05
Total	$35,637	$16.39	10.23	$24,490	$17.83	11.15
Hauling:						
Trucks and bodies:						
Depreciation, interest, insurance, taxes	$18,130	$ 8.34	5.21	$13,468	$ 9.81	6.13
Repair	3,500	1.61	1.01	2,600	1.89	1.18
License	1,015	.47	.29	754	.55	.34
Liability insurance	490	.22	.14	364	.26	.16
Drivers	8,645	3.98	2.48	5,590	4.07	2.54
Fuel	1,630	.75	.47	1,030	.75	.47
Miscellaneous	74	.03	.02	54	.04	.02
Motors	245	.11	.07	182	.13	.08
Total	$33,729	$15.51	9.69	$24,042	$17.50	10.92
Total, all items	$78,674	$36.18	22.60	$54,960	$40.01	24.99

used in the Bunnell section it could not have been used to harvest potatoes packed by the firm's plants located elsewhere. The same situation has prevailed in two of the five years from 1952-1956, inclusive. It appears the firms could not expect to use the same equipment to harvest potatoes for their patrons in several sections of the area. However, they might be able to harvest for their patrons at Bunnell and then do custom work for non-members in other sections. This would be possible since volumes of potatoes harvested decline less rapidly after the peak period in other sections than it does in Bunnell.

CHAPTER 6

COMPARISON OF HARVESTING COSTS, AND OTHER COSTS OF HANDLING POTATOES IN BULK

Estimated costs of harvesting potatoes with methods used by growers in 1956 were compared with estimated costs of harvesting with custom mechanical harvesting units. In comparison of fixed and variable and of labor and equipment costs of different methods, only costs of the custom units required at a harvesting rate of 128 bags per hour per harvester to harvest volumes packed weekly at Plants A and B are used. Also, only these costs incurred by the 12 growers who performed all operations except picking-up and hauling the potatoes in harvesting with the conventional system are included. There was little difference in relative costs of labor and equipment and of fixed and variable cost items between the units of Plants A and B and other custom harvesting units. For the conventional method of harvesting, these costs could be calculated only for those growers who performed all operations except picking-up and hauling.

In addition to the comparison of costs of harvesting, other factors discussed in this chapter are investment in harvesting equipment and changes in packinghouse facilities required to handle potatoes in bulk. Investment required in harvesting with the conventional system and with a one-row harvester is that reported by growers.

Total per Unit Costs

The estimated cost of all growers using the conventional system of harvesting was $55.18 per acre, or 33.05 cents per bag. This was $20.12 per acre, or 11.14 cents per bag, and $8.46 per acre, or 3.88 cents per bag, higher than the cost of the custom units set up to harvest weekly volumes of potatoes for Plants A and B, respectively, Table 34. With 60 acres of potatoes, the average acreage of all growers using the conventional system, these differences would amount to approximately $1,200 and $500 annually. The differences were slightly less for growers who used the conventional system and who hired only picking up and hauling of potatoes.

TABLE 34.--Comparison of estimated costs of harvesting potatoes with specified methods, Hastings area, Florida, 1956

Method of harvesting	Cost per	
	Acre	Packed cwt. (cents)
Custom harvesting units:[a]		
Plant A, daily volumes equal 1956	$39.79	24.88
Plant A, weekly volumes equal 1956	35.06	21.91
Plant B, daily and weekly volumes equal 1956	46.72	29.17
Firm 1, weekly volumes equal 1956	36.18	22.60
Firm 2, weekly volumes equal 1956	40.01	24.99
Diggers, by operations hire:		
All operations	54.08	39.53
Rotobeat, pick up, and haul	53.98	35.13
Pick up and haul	55.81	31.22
All growers	55.18	33.05
One-row harvesters	44.40	26.47

[a] Assumes rate of harvesting to be 128 packed hundredweight equivalent per hour per harvester.

Each grower who used the conventional system of harvesting had a cost that ranged from 4.76 to 20.39 cents per bag higher than that of the estimated cost of harvesting with the custom unit set up to harvest weekly volumes packed at Plant A. For the volume of potatoes produced this would have amounted to a difference in harvesting cost of $176 to $3,194 for the season for individual growers. Only four growers who used the conventional system had a cost per bag that was less than that of the unit set up for Plant B.

The average cost of growers using one-row harvesters was $9.34 per acre or 4.56 cents per bag higher than the estimated cost of harvesting with the custom unit required to harvest weekly volumes of potatoes packed at Plant A. However, cost of harvesting with the one-row unit was $2.32 per acre or 2.70 cents per bag less than the estimated cost of harvesting with the unit set up for Plant B. Cost of harvesting with one-row harvesters was about 6.5 cents per bag less than the cost with the conventional system. Growers who hired all of their harvesting had a cost per bag about 50 percent more than the estimated cost of harvesting with one-row harvesters.

The variation in cost of the different custom harvesting units reflects the reduction that would be obtained if each harvester was used to harvest a larger volume of potatoes. It should be recalled that each harvester of the unit needed to pack weekly volumes of potatoes packed at Plant A would have harvested 206 acres and been in operation 258 hours, while each of those in the Plant B unit would have harvested only 132 acres and been in operation only 166 hours during the season.

Labor and Equipment Costs

Amount of Labor Required

In estimating the amount of labor required to harvest an acre of potatoes with the conventional system, it was assumed that one-half of the cost of hauling potatoes was labor. It was also assumed that labor used in hauling potatoes was paid at the rate of $1.00 per hour. The amount of labor required in picking up potatoes was based on previous research.[1] These data show that in the Hastings area under normal conditions a person picks up an average of 846 pounds of field run potatoes per hour. This amount would pack out 7.9 packed 100 pound bags of potatoes, assuming 15 percent of the amount picked up to be dirt and potatoes unsuitable for shipping. At a yield of 160 packed bags per acre, 22.25 hours of man labor would be required to pick up potatoes from one acre. Amounts of other labor used in harvesting with the conventional system and with one-row harvesters were those reported by growers surveyed.

Labor requirements for the custom harvesting units were computed based on the assumed rates of harvesting and number of workers required. In calculating labor requirements, only the custom harvesting unit that would have been required to harvest weekly volumes of potatoes packed at Plant A was used. To operate the make of harvester assumed, normally one man is used to drive the tractor, one man to operate the controls on the harvester, two people to pick vines and grass out of the potatoes and one person to pick up potatoes behind the harvester that are dropped on the ground.

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[1] Unpublished data, Florida Agricultural Experiment Station.

At a rate of harvesting of .8 acre per hour the unit set up for Plant A would have required approximately 10 hours of man labor per acre, Table 35. Of this amount, 1.25 hours would have been required to drive the tractor, 5.0 hours to operate the harvester and pick up potatoes and the rest to haul potatoes. Harvesting potatoes with one-row harvesters required approximately 27 hours of man labor per acre. About 35 hours of man labor was used per acre in harvesting with the conventional system of harvesting. In the conventional system of harvesting about two-thirds of the total labor required was used in picking-up the potatoes. In the conventional system man labor per acre for picking-up was more than twice the total amount that would have been required in harvesting with custom harvesting units.

TABLE 35.--Estimated hours of labor required in harvesting one acre of potatoes with specified methods, Hastings area, Florida, 1956

Item	Method of harvesting			
	Conventional system	One-row harvester	Mechanical harvesting unit, Plant A	
			.8 acre per hour	.93 acre per hour
Rotobeat	.47	...	...	...
Dig	2.01	...	...	...
Operate harvester	...	15.87	5.00	4.30
Pick up potatoes	22.25	3.79	1.25	1.08
Haul	10.20	6.88	4.07	4.00
All items	34.93	26.54	10.32	9.38

Costs of Labor and Equipment

Total cost of labor in harvesting with the conventional system was approximately four times the estimated cost of labor to harvest with the custom harvesting units set up for Plants A and B, Figure 7 and Table 36. Estimates of cost of labor for mechanical harvesting are for those units that would have been required to harvest, at a rate of 128 bags per hour, the potatoes packed weekly. Labor cost with one-row harvesters was only about two-thirds as much as harvesting with the conventional method. Estimated cost of labor per acre with the conventional system was more than the total estimated cost of harvesting with the mechanical unit set up for Plant A. However, it was slightly less than four-fifths of the total estimated cost of harvesting with the unit set up for Plant B.

Labor cost was only about one-fourth and one-fifth of the estimated total per acre cost of harvesting with the custom units set up for Plants A and B, respectively. In comparison, it accounted for 65 percent of the total cost of harvesting with the conventional system and 56 percent of that of harvesting with one-row harvesters.

Picking up potatoes was the major item of labor and of total cost in harvesting with diggers. Cost of labor used in hauling potatoes was also an important item, being about half as great as the cost of picking-up. With both one- and two-row mechanical harvesters labor used on the harvester, including that used to pick up potatoes behind the harvester, was the major item of labor cost. However, the cost of labor in hauling potatoes was almost as great as that of all labor used on the harvester.

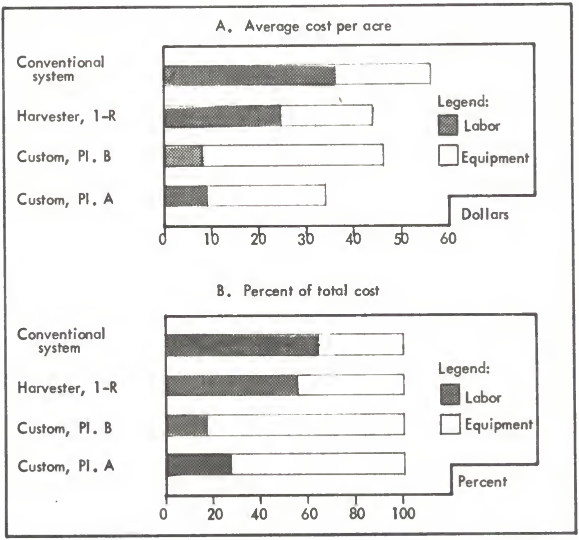

Fig. 7.--Estimated per acre costs and percent of total costs of labor and equipment of harvesting potatoes with specified methods, Hastings area, Florida.

TABLE 36.—Per acre costs of equipment and labor in harvesting potatoes with different methods, by cost items, Hastings area, Florida, 1956.

Item	Method of harvesting			
	Conventional system	One-row harvesters	Custom units	
			Plant A	Plant B
Equipment:				
Depreciation, interest, insurance, taxes:				
Tractor	$ 1.58[a]	$ 3.10[a]	$ 1.70	$ 2.64
Rotobeater	.92	...	...	...
Digger	1.73	...	...	...
Harvester	...	4.98	7.04	10.96
Trucks	10.20[a]	6.88[a]	8.17	13.05
Motors	...	...	.03	.18
Sacks and baskets	1.72	1.18	...	...
Total depreciation, interest, insurance, taxes	$16.15	$16.14	$16.94	$26.83
Repair	1.69	1.60	5.88	7.87
Fuel	...	...	1.07	1.07
Digger chains	1.71	1.20	1.00	1.00
License and insurance on truck	...	...	.68	1.08
Miscellaneous	.17	.35	.30	.42
Total equipment costs	$19.72	$19.29	$25.87	$38.27
Labor:				
Rotobeater	$ .48	...	...	...
Digger	1.70	...	...	...
Harvester	...	$18.23	$ 5.12	$ 5.12
Pick up potatoes	23.94	...	...	...
Haul potatoes	10.20	6.88	4.07	3.32
Total labor	$36.32	$25.11	$ 9.19	$ 8.44
Total, all items	$56.04	$44.40	$35.06	$46.71

[a] Also includes repair, fuel, and miscellaneous items.

Total per acre costs of equipment were major portions of the total cost of harvesting with the custom harvesting units, but were not nearly so important percentagewise in harvesting with diggers and one-row harvesters. With each method, truck cost was a major item of total equipment cost. In harvesting with diggers, truck cost was almost twice as great as was digger cost, the next largest equipment cost. With the custom units for Plants A and B, equipment cost of trucks was slightly larger than that of the harvesters. The cost of the bulk trucks used with the Plant A unit was about $2.00 per acre less, and with the Plant B unit almost $3.00 per acre more, than the cost of the flatbed trucks used with the conventional system. The major portion of equipment costs of each method was comprised of depreciation, interest, insurance, and taxes.

Fixed and Variable Costs

It was mentioned previously that per unit cost of harvesting with the conventional system and with one-row harvesters would decrease very little even with substantial increases in acreage harvested. This is because variable costs comprise a large portion of total costs. With this method of harvesting, most cost items are paid for by the grower on a per unit basis. The amount paid per unit tends to vary very little with amount harvested. Total variable cost of harvesting with the conventional system was approximately $50.00 per acre, or 89 percent of total cost, Figure 8 and Table 37. Variable cost of harvesting with one-row harvesters was 86 percent of the total cost.

In comparison, only 28 and 39 percent of total per acre cost of units required to harvest for Plants B and A, respectively, were variable costs. Hence,

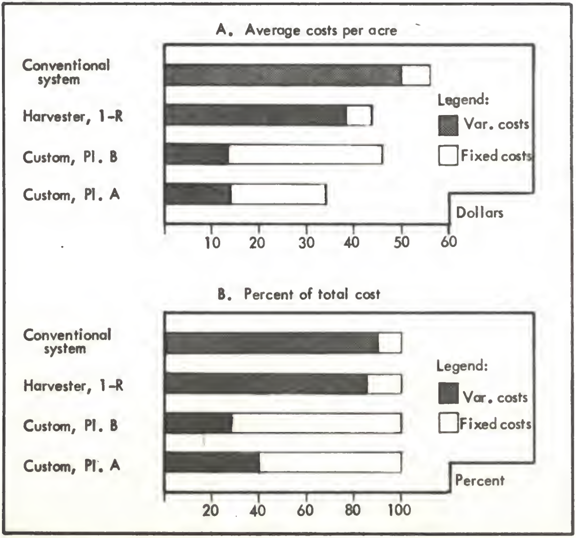

Fig. 8.—Estimated per acre and percent of total costs of fixed and variable costs of harvesting potatoes with specified methods, Hastings area, Florida.

TABLE 37.--Estimated per acre fixed and variable costs of harvesting potatoes with specified methods, Hastings area, Florida, 1956

Item	Method of harvesting			
	Conventional system	One-row harvesters	Custom units[a]	
			Plant A	Plant B
Fixed costs:				
Tractor	...	...	$ 1.70	$ 2.64
Rotobeater	$ 0.92	...	...	...
Digger	1.73	...	...	...
Harvester	...	$ 4.98	7.04	10.96
Trucks and bodies	...	...	8.17	13.05
Labor, repairman	...	...	1.27	1.89
Repair, tractor	...	...	.78	1.21
Repair, rotobeater and digger	1.69	...	...	...
Repair, trucks	...	...	1.58	2.52
License, trucks	...	...	.46	.73
Liability insurance, trucks	...	...	.22	.35
Sacks and baskets	1.72	1.18	...	...
Motors	...	...	.03	.18
Total	$ 6.06	$ 6.16	$21.25	$33.53
Variable costs:				
Labor, pick up potatoes	$23.94	...	...	...
Labor, hauling	10.20	$ 6.88	$ 4.07	$ 3.32
Labor, rotobeating and digging	2.18	...	...	...
Truck, hauling	10.20	6.88	...	...
Labor harvester	...	18.23	5.12	5.12
Tractor use	1.58	3.10	...	...
Repair, harvester	...	1.60	2.25	2.25
Digger chains	1.71	1.20	1.00	1.00
Fuel, truck	...	...	.75	.75
Fuel, tractor	...	...	.32	.32
Miscellaneous, all	.17	.35	.30	.42
Total	$49.98	$38.24	$13.81	$13.18
Total, all items	$56.04	$44.40	$35.06	$46.71

[a] These are custom units that would have been required to harvest, at a harvesting rate of 128 packed hundredweight equivalent of potatoes per hour per harvester, potatoes packed weekly in 1956.

total cost per acre and per bag would have decreased rather rapidly, within wide limits, as volume harvested per hour with each two-row harvester increased.

Other Costs of Mechanical Harvesting Method

There are other expenses not included in the data used in comparing costs. One of these is the cost of moving the harvesters from the field of one grower to that of another. It is estimated that this would have required one hour of labor and one hour of tractor operation per harvester per day at a cost of about $4.25 per day, or .4 cent per bag of potatoes. Other costs not included and only sometimes incurred are those involved in preparing for the harvesting operation. "Barring off rows," or cutting the dirt and weeds from the sides of the bed and throwing them between the beds, and rotobeating are two such items. Only one of these operations is normally performed. An estimated cost of performing each of these operations is 1.5 cents per bag of potatoes. Sometimes drainage ditches must be leveled. This cost as well as barring off and rotobeating, would likely have been performed by the grower rather than the firms but should be kept in mind though not estimated.

Other Factors

Factors other than harvesting costs are important in harvesting and handling potatoes in bulk. Two of these are the initial investment in equipment and changes in facilities that would be required for handling potatoes at the packinghouse.

Investment

Investment in different types of potato harvesting equipment is of importance from the standpoints of the financial ability of the grower to make a purchase. Average investment in equipment of growers using the conventional system who relied upon custom operators only for picking up and hauling potatoes was approximately $1,710, excluding tractors and trucks. This included $545 for a rotobeater, $864 for a digger, and $300 for baskets and sacks. Investment in one-row harvesting equipment was approximately $2,110 per grower per harvester and $200 for sacks. Tractors required for the conventional method and one-row harvesters would cost about $2,625 and $3,000, respectively. However, only 10 percent or less of the total annual use of a tractor would be confined to potato harvesting. The investment in equipment for the harvesting units set up to harvest, at a rate of 128 bags per hour, volumes of potatoes packed weekly at Plants A and B in 1956 would be $80,300 and $61,160, respectively. For Plant A this would be about $3,000 per grower and for Plant B about $5,000 per grower. These figures include trucks for hauling the potatoes. Growers who used the conventional system and one-row harvesters hired rather than owned their trucks. If trucks used with the custom harvesting units were hired, total investment in equipment used would be $52,610 for Plant A and$32,160 for Plant B. On a per grower basis, investment would be less than $2,000 for Plant A and approximately $2,600 for Plant B.

Average investment per acre including tractors and excluding trucks would be $22 for the conventional system, $12 for one-row harvesting equipment, $52 for the Plant A unit, and $81 for the Plant B unit. If trucks are included in the custom harvesting units, the per acre investment would be $97 for the Plant A unit and $132 for the Plant B unit.

An individual grower with bulk harvesting equipment would have to harvest over 200 acres to have a per acre investment as low as that of the Plant A custom unit. The individual's total investment would be approximately $7,515. This amount would include $5,800 for the harvester, $1,650 for bulk bodies, and $65 for the electric motor used to unload the potatoes. It does not include any value for a tractor to pull the harvester or trucks to haul the potatoes.

Changes in Packinghouse Facilities

Different receiving facilities are needed at packinghouses to handle potatoes in bulk from those required to handle potatoes in bags. Potatoes handled in bags are manually emptied from the bags directly onto the packing line; or the potatoes are emptied into bins or the sacks set off in racks for temporary storage. When potatoes are hauled in bulk they may be unloaded directly on a conveyor that takes them to the washing and grading equipment. They may be transferred from the bodies and placed by means of an elevator in bulk bins for temporary storage. In the Hastings area bins are usually constructed in two parallel rows of four or more on each side with some type of conveyor between the bins for conveying the potatoes to the washer.

Since potatoes harvested mechanically and handled in bulk often contain more dirt than those harvested and handled in the conventional way, a flume rather than a conveyor has been found more desirable to convey potatoes to the packing line. The installation cost is about the same for each method. The flume is a long trough, trapezoidal in shape and usually made of steel, through which water is pumped from a well nearby. If bulk bins are used, the flume is placed between the two rows of bins. The side of each bin next to the flume is equipped with small trap doors near its bottom. The doors are used to release the potatoes and also control their rate of flow out of a bin. When the bins are emptied, the potatoes fall directly into the water flowing through the flume. The force of the flowing water washes out the soil and conveys the potatoes to the end of the flume where they fall onto a conveyor leading to the packing line. The flume is extended far enough beyond the bins so bulk trucks can be backed up to it and potatoes unloaded directly from the trucks.

Estimated Cost of Altering Facilities for Bulk Handling

The cost of altering a packinghouse to handle potatoes in bulk depends on facilities already in use that can be employed. If temporary storage space is desired and not available, the facilities must be altered to include bulk bins, unloading elevators, a flume and a well and pump. In some cases the well that supplies the water to wash the potatoes may also furnish sufficient water to operate the flume.

The cost of facilities for receiving bulk handled potatoes will depend upon such things as the amount of storage space desired, size and depth of well, size of pump, length of flume and other factors. The usual requirements in the Hastings area seem to be a well 30 feet deep and four inches in diameter, eight bins with a capacity of 200 bags each, a flume, and two unloading elevators. The estimated cost per unit of the facilities needed are shown in Table 38. The total cost of installing all of these facilities would be $9,033.

TABLE 38.--Cost of packinghouse facilities needed to handle potatoes in bulk, Hastings area, Florida

Item	Unit	Price	Usual installation	
			Number of units	Cost
Well:				
4"	foot	$ 2.50	30	$ 75
6"	foot	4.20		
Motor and well pump:				
3 H.P., 4"	each	590.00	1	590
7-1/2 H.P., 6"	each	675.00		
Flume	linear ft.	9.00	60	540
Bulk bins[a]	8 bins	3,828.00	1	3,828
Unloading elevator	each	2,000.00	2	4,000
All items				$9,033

[a] Each bin is 11 by 10 feet and has a capacity of approximately 200 packed bags equivalent of potatoes.

CHAPTER 7

PROBLEMS OF CUSTOM MECHANICAL HARVESTING BY MARKETING FIRMS

Mechanical harvesting and bulk handling of potatoes have given rise to a number of problems. Some of these problems are inadequate facilities at packinghouses for receiving potatoes handled in bulk, excessive damage to potatoes by the harvester, excessive amounts of dirt and trash in the potatoes, field conditions not conducive to mechanical harvesting, and coordination of packing and harvesting operations. In addition to these problems, custom harvesting by marketing firms would result in others. The purpose here is to discuss the major problems foreseen in custom harvesting by firms and to discuss possible solutions.

Attitude of Growers toward Custom Mechanical Harvesting

Attitudes and opinions of patrons of the firms included in this study were unfavorable toward custom harvesting by their firms and toward changes that would likely be required or desirable with this type of arrangement. In general, however, growers were so accustomed to the traditional mode of operation of their organization that it seemed they could not think objectively in terms of such a new arrangement and the necessary changes they would likely have to make. This attitude prevailed despite the fact that some growers, those with small acreages especially, seemed aware that sometime in the near future there would be a shift from primarily manual to almost fully mechanical harvesting.

A number of factors are probably responsible for this general attitude of opposition to custom mechanical harvesting. Traditionally, production and marketing of vegetables is rather highly, although imperfectly, competitive. Another factor may be the high prices and net returns for potatoes that farmers have received in the past several years prior to the 1957 season. Thus, there has been no pressing need to think of substantially reducing production and handling costs in order to maintain net returns at a level sufficient to allow the farmer to remain in business.

Traditionally, farmers in general are slow to accept new techniques and methods. Also, there may have been, on the part of individual growers, a lack of sufficient information about the potential savings possible through the use of custom two-row mechanical harvesters. With more information, growers might view the situation differently and have a more favorable attitude toward custom harvesting by their firms.

Only three growers reported that they had considered the possibility of their marketing organization's owning and operating two-row mechanical harvesting equipment on a custom basis for their patrons, Table 39. Only one reported that he knew of no problems that would be involved in such a harvesting arrangement. Twelve growers said the investment involved in such an undertaking would be too great for their organization. Eleven growers said that there would be too many growers wanting their potatoes harvested at the same time. Five growers indicated they thought there would be a major problem in obtaining laborers with the ability to handle the equipment efficiently and economically. In general, the growers

TABLE 39.--Number of growers who had considered the possibility of custom mechanical harvesting by their firm and number of growers reporting specified problems of such a harvesting arrangement, 23 growers, Firms 1 and 2, Hastings area, Florida, 1956

Item	Number of growers reporting specified problems		
	Hired all operations	Performs some operations	All growers
Number of growers interviewed	6	17	23
Growers who had considered custom harvesting by firms	2	1	3
Problems reported:			
Investment too large	2	10	12
Too many want to harvest at same time	3	8	11
Labor problem too great	...	5	5
Inefficient operation	1	1	2
Weather hazard	1	1	2
Farmers would not cooperate	...	1	1
No problem	1	...	1

expressed doubt that such an arrangement would ever work or be accepted by them because of the problems involved. However, with more information some of these growers might become interested enough to explore the situation and alternatives to the system under which they are operating.

Coordination of Harvesting and Packing Operations

For efficient and economical operation of a packinghouse, there must be a supply of potatoes sufficient to keep the house in operation as continuously as possible. Otherwise, costs tend to increase rapidly. The common practice is to pay the general working force during plant stoppages of no longer than 15 to 30 minutes. Some workers are paid on a weekly or monthly basis. Some additional cost results from starting and stopping the plant. Also, the volume of potatoes that can be harvested and packed in a given amount of time is decreased unless an even flow of packing is maintained.

If the rate of harvesting potatoes is faster than the rate of packing, either the harvesters must be stopped or there must be adequate temporary storage space to store the excess potatoes. If storage space is not available, there must be a sufficient number of bulk trucks to hold the potatoes until the plant can pack them. When harvesters are stopped, wages of the workers operating the harvesting equipment continue, thus rapidly increasing the per unit cost of harvesting. Increasing the number of trucks would likely be impractical because of the added cost of hauling the potatoes.

Supervision of Custom Harvesting Units

Coordinating the packing and harvesting operations would depend largely upon adequate supervision of the custom harvesting units. This supervision could be performed by the field men of the marketing firms. Among their responsibilities would be keeping up with personnel of the harvesting unit, seeing that the harvesters were operated for the desired period of time each day, that they were moved from field to field at the proper time, and perhaps determining the order in which different grower's potatoes would be harvested. It would be the repairman's job to keep the equipment in operating condition.

It is likely that only one harvester would be operated for one grower at any time. The harvesters probably would be operated for different farmers on consecutive days, especially during the peak of the harvesting season, for it would not be economical to move a machine from the field of one grower to that of another more often than once a day. Changing fields less often would be desirable providing arrangements relative to other factors could be worked out so that they would be equitable among, and satisfactory to growers.

Pattern of Harvesting and Packing During the Week

For the seasons as a whole, Firm 1 sold as many or more potatoes on Friday than on any other day of the week in the 1955 and 1956 seasons, Table 40. In 1954, a greater percentage was sold on Tuesday, Wednesday, and Thursday than was sold on Friday. At Firm 2, Wednesday and Friday were the days of largest volume of sales in 1955 and Tuesday and Wednesday in 1956. Monday and Saturday were the days of least volume of sales at both firms in each year. Often, sales made on Saturday were for potatoes harvested and sometimes packed on Friday and held over until Saturday. The usual practice is to operate the packinghouses for only a few hours, if at all, on Saturday.

During four weeks of the 1955 and 1956 seasons, Firm 1 sold more potatoes on Friday than on any other day of the week, Table 40. Except for Tuesday, no other day of the week had the highest daily volume of sales for more than one week of the season. In 1954, the highest daily volume of sales during a week was made on Wednesday for four weeks and on Tuesday for two weeks. In no week during the three seasons were the sales greater on Monday than on any other day. At Firm 2 in 1956 the highest daily volume of sales during the week occurred on Friday for four weeks and Tuesday and Thursday for two weeks.

To follow a pattern of harvesting and packing varying daily and weekly

TABLE 40.--Number of times during the season daily sales during a week were highest on specified days of the week, and proportion days sales on specified days were of total sales for the season, Firms 1 and 2, Hastings area, Florida, 1954-56

Day of week	Number of times daily sales highest on:			Percent of total season's sales on:		
	1954	1955	1956	1954	1955	1956
			Firm 1			
Monday	...	...	...	13.3	12.3	15.1
Tuesday	2	1	1	19.9	18.0	20.2
Wednesday	4	1	...	20.7	18.9	16.1
Thursday	1	1	2	19.6	19.2	19.7
Friday	1	4	4	18.9	22.0	20.2
Saturday	...	1	...	7.6	9.6	8.7
Total	8	8	7	100.0	100.0	100.0
			Firm 2[a]			
Monday		...	...		14.2	14.1
Tuesday		1	2		18.6	20.6
Wednesday		3	1		21.3	20.0
Thursday		1	2		19.3	19.4
Friday		2	4		21.8	18.8
Saturday		...	...		4.8	7.1
Total		7	9		100.0	100.0

[a] Data for Firm 2 in 1954 were not obtained.

volumes of potatoes, as has been true for these firms in the past, the mechanical harvesters would have to be operated for a varying number of hours each day or week. This would be necessary to avoid the expense of building a larger amount of temporary storage space in which to accumulate a volume sufficient to supply the packinghouse with potatoes on days of heaviest packing.

An alternative would be to operate the harvesters at a rather constant number of hours per day and pack the potatoes at a uniform rate. This in turn would mean the potatoes would have to be sold at a uniform rate each day or else some stored after being packed. The latter would call for extra handling of the potatoes, increase chances of damage and would likely require more storage space than is now available at most packinghouses. If potatoes were marketed at a uniform rate, prices might be different from what they would be otherwise. It is beyond the scope of this study to explore this situation fully. All that can be done is to point out that the problem would exist. However, it is more likely the pattern of packing will continue to be determined by market demands.

Order of Harvesting for Individual Growers

If a custom harvesting unit is to be operated most economically by a marketing firm, it will be necessary to harvest potatoes for fewer growers on some days than the number harvested in 1956. Since coordination of packing and harvesting operations and costs of harvesting would be affected and since growers apparently attach much importance to harvesting when they wish, the determination of the order in which potatoes of individual growers would be harvested is an important problem. The difficulties of this problem can be fully understood only when one considers the factors that growers take into account in deciding on which day they will harvest their potatoes. Any feasible solution of the problem will of necessity have to take into consideration these factors.

Each grower interviewed said he considered maturity of the potatoes in deciding when to harvest, Table 41. A few mentioned carrying quality and yield which are related to maturity. Carrying quality refers to what extent the potatoes maintain through the marketing system the quality when harvested. The stage of

TABLE 41.--Number of growers who considered specified factors when deciding when to harvest potatoes, by harvesting practices, 23 growers, Firms 1 and 2 Hastings area, Florida, 1956

Factors considered	Growers who:		All growers
	Hired all operations	Performed some operations	
Maturity of potatoes	6	17	23
Price	6	11	17
Weather	4	1	5
Carrying quality	...	2	2
Yield	...	2	2
Other	1	3	4

maturity affects carrying quality. Time of harvest is also associated with yield, since the potatoes are still growing when they first become mature enough to be harvested and marketed with a reasonable amount of deterioration in transit.

Seventeen of the 23 growers reported that they considered price in deciding when to harvest potatoes. Most of these indicated that both current and expected prices were important. However, if prices were pooled over a period of a week or longer, daily price variation would not be of extreme importance in determining order of harvesting. As was shown in Table 5 potatoes of few of the patrons of Plant A would have had to be harvested with custom units in different weeks in 1956 than those in which the growers themselves harvested them. Only five growers reported that they considered weather as a factor influencing the exact date of harvesting potatoes. Nevertheless, it may be a very important factor. Excessive moisture increases the rate of natural deterioration and damage from insects and diseases, particularly when potatoes are in a late stage of maturity.

Any method of assigning the order in which growers' potatoes would be harvested would probably result in some problems or inequities in relation to some of these factors. It would probably be desirable to compensate growers for any loss sustained as a result of the custom harvesting arrangement. The compensation could likely be made in the pricing system.

There are a number of ways in which order of harvesting could be determined other than on a first come, first served basis. All of these no doubt would have some objectionable features and not meet the approval of all growers concerned.

Harvest in order of growers intentions.--Potatoes for individual growers could be harvested according to their intentions to harvest. Growers could be required to announce ahead of time their desire as to time of harvest. The order of harvesting would be the same as the order of the announced intentions. This method would give individual growers considerable freedom of decision-making. The major requirement of such a method would impose on growers the need to determine ahead of time approximately when their potatoes would be ready for harvest and when they would want them harvested. Also, it would be necessary to limit the amount to be harvested within a period to the amount that could be packed by the plant.

Harvest in order of planting dates.--Potatoes of different growers could be harvested in the same order in which they were planted. Planting dates could be left to the discretion of individual growers and reported to the association, or they could be assigned. If each grower was allowed to plant potatoes any time he chose, at some time during the season, there would undoubtedly be more potatoes ready to harvest than the firm could pack. During such times, there would still be a problem of the order in which to harvest for individual growers. Perhaps an arrangement could be made for a field man of the firm to make the decision. However, this could lead to dissatisfaction among growers, particularly in the event of rapid price drops or damage to the potatoes that might occur during the waiting period.

A committee, perhaps the Board of Directors of a firm, could set up a schedule of acreages to be planted by dates. Acreages could be assigned to growers on a first come, first served basis and according to growers' desires insofar as possible. There are at least three disadvantages of assigning planting dates to growers. Each method would deprive the grower of some chance to exploit whatever opportunity and ability he might have to select harvesting dates that would result in greatest returns for his potatoes. Also, it would probably be difficult to determine the acreage that would have to be planted each day to keep the packinghouse operating at optimum capacity and to meet orders from buyers. It would also be difficult to assign acreages in such a manner they could be harvested in exactly the same order in which they were planted. Potatoes planted at different dates do not require the same number of days to reach maturity. Thus, on some days in some seasons there would likely be more potatoes ready for harvest than could be packed. The order of harvesting would have to be adjusted from the order of dates of planting.

A modification of the plan of assigning planting dates would be to determine the order of harvesting by planting dates during the three weeks of peak harvesting and packing only. Planting could be regulated by assigning planting dates to growers during the weeks of heaviest planting only. These weeks could probably be determined soon after the start of planting in the area. A committee could set up a schedule of acreages to be planted by dates during these weeks and allocate acreages to growers by any of the methods already discussed. This system would give individual growers more freedom perhaps than would the other methods.

Planting dates could be assigned to growers by a planning committee in such a manner as to keep to a minimum the movement of the harvesting equipment from one field to another. A plan similar to this is followed by a celery marketing cooperative.[1] Officials of the association would determine the order in which the potatoes would be harvested. A seasonal or semi-seasonal price pool would probably have to be used. The price pooling system would also need to include provision for usual differences in yield among localities, variations in yield due to differences in the stage of maturity of potatoes when harvested and loss or damage of potatoes when the crop could not be harvested at the proper time because of weather or other factors. In addition, the firm would likely have to plant potatoes for growers. Many growers do not have enough equipment to plant their entire acreage of potatoes in the short period that would be required.

Determining planting dates by heat units.-- It has been found that most vegetables require a certain amount of heat to reach maturity from time of planting. Heat units are a measure of the amount of heat received. If the heat unit requirement for potatoes in this area of Florida were determined and if sufficient information on daily temperature were available, this method might be a satisfactory basis for arranging planting dates for efficient operation of the custom harvesting unit and of the packinghouses. This information could not be used directly in determining the order in which potatoes of different growers would be harvested. It would be useful in determining more accurately the total acreage of potatoes that should be planted on given days so that enough but not too many potatoes would be ready for harvesting and packing in given time periods. If this were accomplished, fewer exceptions to harvesting in the order of planting dates would have to be made.

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[1] The Palmer Growers Cooperative Association of Sarasota, Florida has for four years raised celery plants, determined the planting dates, and planted the celery plants for its members. Receipts from the sale of the celery are pooled on a seasonal basis by varieties, grades, and sizes. In planting and harvesting the celery, the equipment is started at one end of the area where members' farms are located. The order in which the operations are performed for individuals is determined in such a way as to minimize road travel of the equipment.

System of Price Pooling

With a custom harvesting arrangement as outlined in this study, the advantages of a daily price pooling system would be reduced. Hence, it was considered desirable to investigate attitudes of growers toward various pooling arrangements and the effects of such arrangements upon returns to individual growers.

Attitudes of Growers

Only three growers said that they thought the present system of daily price pooling would be satisfactory to use with custom mechanical harvesting, Table 42. Seven growers said they did not know whether or not it would be satisfactory. Only two growers said that they felt a price pooling period of longer than one day's duration would be satisfactory and eight said that they did not know. In effect, these comments seem to indicate that these growers felt there is no price pooling system that would be compatible with custom harvesting of potatoes by marketing

TABLE 42.—Number of growers reporting that specified price pooling arrangements would be satisfactory with custom mechanical harvesting by marketing firms, and number of growers making specified comments relative to a price pooling period of longer than one day, 23 growers, Firms 1 and 2, Hastings area, Florida, 1956

Item	Growers who hired all operations	Growers who performed some operations	All growers
Number of growers interviewed	6	17	23
Daily price pool satisfactory?			
Yes	1	2	3
No	3	10	13
Do not know	2	5	7
Price pool period of over one day satisfactory?			
Yes	2	0	2
No	2	11	13
Do not know	2	6	8
Comments on price pool longer than one day:			
Daily price variation too great	3	5	8
Some growers favored over others	1	3	4
Require too complicated bookkeeping system	...	1	1
Each day should stand on its own	...	1	1
Independent growers would not be affected	...	1	1
Might work, depending on price and weather	...	1	1
Too many packinghouses in area for anything but a daily pool	...	1	1

firms and with which growers would be satisfied.

It was primarily on the questions that brought forth the above comments that growers indicated their unwillingness or inability to think of conditions other than those under which they had been operating. They felt that a daily price pooling system would not work because more growers would want to harvest on given days than the custom harvesting unit could serve. The major objections given to a pooling period of longer than one day was that prices varied too much from day to day, and certainly from week to week. In general, these comments seemed to indicate that the growers were thinking only of the equitability of the pricing system and not of how to make the custom harvesting arrangement work. A number of growers with small acreages said they could get all their potatoes harvested and packed in a short period of high prices whereas growers with large acreages could not; this was the only advantage they had over growers with larger acreages.

Effect of Specified Price Pools upon Returns to Growers

To determine the extent to which returns might vary under different price pooling arrangements, a study was made of returns to individual growers and particular groups of growers under hypothetical price pooling arrangements. The data covered the three years 1954 to 1956 for one firm and the two years 1955 and 1956 for the other firm.

From daily pool prices and volume of potatoes sold in each of the years studied, weighted average weekly, semi-seasonal, and seasonal prices were calculated for each of two associations. Using these prices as a basis, gross annual returns from weekly, semi-seasonal, and seasonal price pooling were computed for individual growers and for groups of growers according to the number of days during the season potatoes were sold and according to the volume of potatoes sold during the season. These returns were compared with those received for prices pooled on a daily basis.

Seasonal price pool.--Between 42 and 60 percent of the patrons of Firm 1 would have received a return from seasonal price pooling that was at least $1,000 different from that which they received from daily price pooling in the years 1954-56, Table 43. In 1954 and 1955, respectively, approximately 8 and 13 percent of the patrons would have had returns from seasonal price pooling that were over \$5,000 above or below their receipts from daily price pooling. About the same situation would have existed in 1955 and 1956 for the patrons of Firm 2. Though not shown in the table, returns to at least one individual grower from seasonal price pooling would have varied by over \$18,000 from his receipts by daily price pooling. Such differences to individual growers would likely equalize themselves over the years, being high in some years and low in others. However, since some sections of the area usually have higher prices than other sections, and since the differences between receipts from seasonal and from daily price pooling are so great, growers in general would probably not consider seasonal price pooling an equitable or satisfactory pricing arrangement. It does, of course, spread price risk among growers harvesting at different times of the season.

Semi-seasonal price pool.—Differences in receipts from daily price pooling and semi-seasonal price pooling also would have been great for a large proportion of the growers, Table 44. To individual growers, these differences would have amounted to as much as \$11,434, or over \$1.22 per hundredweight. Such differences would probably be too great to permit the use of semi-seasonal price pooling as a satisfactory pricing system.

Weekly price pool.-- By comparison, only 11 percent of the patrons of Firm 1 in 1956 had receipts from daily price pooling that varied by over \$1,000 from what their receipts would have been with weekly price pooling, Table 45. These

TABLE 43.--Difference between total returns from daily price pooling and what returns would have been from seasonal price pooling, Firms 1 and 2, Hastings area, Florida, 1954-56

Difference in total returns (Dollars)	Percent of growers that would have made a:					
	Firm 1			Firm 2		
	Gain	Loss	Total	Gain	Loss	Total
			1954[a]			
100 or less	3.3	0.0	3.3			
101 - 500	8.2	9.8	18.0			
501 - 1,000	11.5	3.3	14.8			
1,000 - 5,000	24.6	31.2	55.8			
over 5,000	4.9	3.2	8.1			
Total	52.5	47.5	100.0			
			1955			
100 or less	0.0	1.8	1.8	8.3	3.3	11.6
101 - 500	3.7	14.9	18.6	10.0	6.7	16.7
501 - 1,000	3.7	24.0	27.7	6.7	6.7	13.4
1,001 - 5,000	18.5	20.4	38.9	21.7	26.6	48.3
over 5,000	7.4	5.6	13.0	5.0	5.0	10.0
Total	33.3	66.7	100.0	51.7	48.3	100.0
			1956			
100 or less	3.7	7.4	11.1	3.6	8.9	12.5
101 - 500	9.3	13.0	22.3	16.1	12.5	28.6
501 - 1,000	16.6	7.4	24.0	8.9	5.4	14.3
1,001 - 5,000	24.1	18.5	42.6	16.0	25.0	41.0
over 5,000	0.0	0.0	0.0	1.8	1.8	3.6
Total	53.7	46.3	100.0	46.4	53.6	100.0

[a] Data for Firm 2 in 1954 were not obtained.

TABLE 44.--Difference between total returns from daily price pooling and what returns would have been from semi-seasonal price pooling, Firms 1 and 2, Hastings area, Florida, 1954-56

Difference in total returns (Dollars)	Percent of growers that would have made a:					
	Firm 1			Firm 2		
	Gain	Loss	Total	Gain	Loss	Total
			1954[a]			
100 or less	6.6	0.0	6.6			
101 - 500	13.1	13.1	26.2			
501 - 1,000	8.2	9.9	18.1			
1,001 - 5,000	21.3	26.2	47.5			
over 5,000	1.6	0.0	1.6			
Total	50.8	49.2	100.0			
			1955			
100 or less	1.9	1.8	3.7	5.0	11.7	16.7
101 - 500	7.4	11.1	18.5	11.7	13.3	25.0
501 - 1,000	18.5	5.6	24.1	3.3	8.3	11.6
1,001 - 5,000	22.2	25.9	48.1	21.6	21.7	43.3
over 5, 000	3.7	1.9	5.6	1.7	1.7	3.4
Total	53.7	46.3	100.0	43.3	56.7	100.0
			1956			
100 or less	7.4	5.6	13.0	5.4	7.1	12.5
101 - 500	5.6	14.8	20.4	12.5	16.1	28.6
501 - 1,000	16.6	7.4	24.0	5.4	14.3	19.7
1,001 - 5,000	24.1	18.5	42.6	12.5	25.0	37.5
over 5,000	0.0	0.0	0.0	1.7	0.0	1.7
Total	53.7	46.3	100.0	37.5	62.5	100.0

[a] Data for Firm 2 in 1954 were not obtained.

TABLE 45.--Difference between total returns from daily price pooling and what gross returns would have been from weekly price pooling, Firms 1 and 2, Hastings area, Florida, 1954-56

Difference in total returns (Dollars)	Percent of growers that would have made a:					
	Firm 1			Firm 2		
	Gain	Loss	Total	Gain	Loss	Total
1954[a]						
100 or less	9.9	11.5	21.4			
101 - 500	39.3	26.2	65.5			
501 - 1,000	4.9	6.6	11.5			
1,001 - 5,000	0.0	1.6	1.6			
Total	54.1	45.9	100.0			
1955						
100 or less	13.0	18.5	31.5	18.3	16.7	35.0
101 - 500	24.1	24.1	48.2	26.7	25.0	51.7
501 - 1,000	9.3	5.5	14.8	3.3	6.6	9.9
1,001 - 5,000	1.8	3.7	5.5	1.7	1.7	3.4
Total	48.2	51.8	100.0	50.0	50.0	100.0
1956						
100 or less	14.8	18.5	33.3	14.3	23.2	37.5
101 - 500	22.2	16.6	38.8	19.6	23.2	42.8
501 - 1,000	7.4	9.3	16.7	5.4	1.8	7.2
1,001 - 5,000	5.6	5.6	11.2	7.1	5.4	12.5
Total	50.0	50.0	100.0	46.4	53.6	100.0

[a] Data for Firm 2 in 1954 were not obtained.

differences would have existed for only about half as many growers in 1954 and in 1955. Differences in receipts from daily and weekly price pooling would have been less than $500 for over 70 percent of the growers involved in each of the three years studied.

On a per hundredweight basis, differences in receipts from these two price pooling periods would have been less than five cents for over 50 percent of the sellers in each of the three years, Table 46. About the same differences in returns would have existed for the patrons of Firm 2.

TABLE 46.--Difference in prices received per 100 pounds of potatoes from daily price pooling and what prices would have been from weekly price pooling, Firms 1 and 2, Hastings area, Florida, 1954-56

Difference in price received per hundredweight (Cents)	Percent of growers that would have made a:					
	Firm 1			Firm 2		
	Gain	Loss	Total	Gain	Loss	Total
1954[a]						
Less than 1.0	6.6	6.6	13.2			
1.0 - 4.9	19.7	22.9	42.6			
5.0 - 9.9	13.1	8.2	21.3			
10.0 - 19.9	4.9	6.6	11.5			
20.0 and over	9.8	1.6	11.4			
Total	54.1	45.9	100.0			
1955						
Less than 1.0	5.6	9.3	14.9	1.7	8.3	10.0
1.0 - 4.9	18.5	20.3	38.8	16.7	16.7	33.4
5.0 - 9.9	16.7	7.4	24.1	15.0	16.7	31.7
10.0 - 19.9	7.4	7.4	14.8	8.3	5.0	13.3
20.0 and over	1.8	5.6	7.4	8.3	3.3	11.6
Total	50.0	50.0	100.0	50.0	50.0	100.0
1956						
Less than 1.0	5.6	7.3	12.9	7.1	3.6	10.7
1.0 - 4.9	16.7	16.7	33.4	17.8	28.6	46.4
5.0 - 9.9	18.5	11.1	29.6	14.3	5.4	19.7
10.0 - 19.9	5.6	3.7	9.3	1.8	10.7	12.5
20.0 and over	3.7	11.1	14.8	5.4	5.3	10.7
Total	50.1	49.9	100.0	46.4	53.6	100.0

[a] Data for Firm 2 in 1954 were not obtained.

Thus, it appears that pooling of prices on a weekly basis would be more equitable and desirable to individual growers than pooling on a seasonal or semi-seasonal basis. This does not mean, however, that a price pooling period of longer than one week would not be preferable sometime in the future, especially if it could be better coordinated with the custom harvesting arrangement. However, it is likely that the longer the price pooling period, the greater the differential in returns between the longer period and the daily price pooling period. Thus, considering the past operation of the organizations studied and the attitudes and opinions of the growers involved, it appears that weekly price pooling would be the most satisfactory if there is a change from daily price pools.

Since some growers thought they would not have been able to get returns from weekly price pooling that were as high as those from daily price pooling, the price pool data were analyzed to see if this would have been the case in the past. Of 44 growers who sold their potatoes through Firm 1 during the years 1954 to 1956, the proportion having a higher return each year from daily price pooling than they would have had from weekly price pooling was less than would be expected by chance alone, Table 47.[2] The proportion of growers having gains more or less often than

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[2] The percent of growers that would be expected to have each combination of gain and loss through chance was determined as outlined below. The only way in which a gain in three years and no losses could occur would be for a gain to occur in each of the three years. There are three ways in which a gain in two years and loss in one year could occur. These ways are (1) a gain in 1954 and 1955 and a loss in 1956,(2) a gain in 1954 and 1956 and a loss in 1955, and (3) a gain in 1955 and 1956 and a loss in 1954. Similarly, there are three ways in which a loss in two years and a gain in one year, and one way in which a loss in all three years could occur. Thus, there are a total of eight ways in which a combination of annual gains and losses could occur in three years. A gain in all three years and a loss in all three years each account for one-eight, 12.5 percent, of the total number of possibilities. A gain in two years and a loss in one year, and a loss in two years and a gain in one year, each account for three-eights, 37.5 percent, of the total number of ways in which the gain and loss combinations could occur. Thus, if gains and losses were a matter of chance alone, these are the percentages of growers that would be expected to have the specified combinations of gains and losses.

TABLE 47.--Percent of growers with specified combinations of gains and losses in returns from daily price pooling relative to what returns would have been from weekly price pooling during three years, and percent of growers that could be expected to have these combinations through chance, Firm 1, Hastings area, Florida, 1954-56

Years of gains and/or losses	Percent of growers[a]	
	Having combination	Expected to have combination by chance
Gains all three years	6.8	12.5
Gains two years, loss one year	47.8	37.5
Losses two years, gain one year	29.5	37.5
Losses, all three years	15.9	12.5
Total	100.0	100.0

[a] A chi-square test of significance indicates no difference, at the .95 level, between the percentages of growers having the specified combinations of gains and losses and those expected to have them by chance alone.

losses from daily as compared to weekly price pooling was little different than would be expected by chance.

Although not shown, about the same situation existed for patrons of Firm 2, except that the proportion of growers showing various combinations of gains or losses was more nearly equal to the combination that would be expected by chance alone. It seems that there are probably very few growers, if any, who can consistently sell at a higher price on a daily pool pricing basis than they could on a weekly pool pricing basis.

As indicated by the amount of potatoes sold through the cooperative, small growers as compared to large growers would have fared no worse on a weekly price pooling basis than they did on a daily price pooling basis, Table 48. In general, TABLE 48.--Difference in price received per hundredweight of potatoes sold by daily price pooling and what price would have been by weekly price pooling, by amount of potatoes sold per grower, Firms 1 and 2, Hastings area, Florida, 1954-56

Hundredweights of potatoes sold per grower (cents)	Firm 1			Firm 2		
	Percent of growers in size group	Cwt. sold per grower	Difference in price per cwt. (cents)	Percent of growers in size group	Cwt. sold per grower	Difference in price per cwt. (cents)
			1954[a]			
Less than 3,000	23.0	1,250	13.3			
3,000 - 4,999	31.1	3,979	-1.2			
5,000 - 7,499	14.8	6,308	-4.8			
7,500 and over	31.1	12,801	0.5			
			1955			
Less than 3,000	25.9	1,741	-2.1	36.7	840	2.4
3,000 - 4,999	27.8	4,100	-2.0	18.3	4,045	0.4
5,000 - 7,499	22.2	16,215	0.1	16.7	6,097	-1.3
7,500 and over	24.1	15,010	0.9	28.3	13,427	0.1
			1956			
Less than 3,000	24.1	1,322	-8.4	35.7	1,195	-3.7
3,000 - 4,999	24.1	3,647	-4.6	19.6	3,915	0.6
5,000 - 7,499	27.7	6,200	-1.9	14.3	6,120	1.9
7,500 and over	24.1	12,536	0.6	30.4	13,185	-0.1

[a] Data for Firm 2 in 1954 were not obtained.

returns to various size growers were approximately the same for each of the two methods of pooling. Only in 1954, did small growers show a higher gain from daily price pooling in relation to weekly price pooling than did large growers. If any size group had consistently received higher returns from daily price pools as compared to weekly price pooling, they also would have consistently shown a higher positive difference.

Growers who sold potatoes on from only one to six days during the season had a higher return from daily pool pricing during each of the three years than they would have had from weekly price pooling, Table 49. However, for patrons of Firm 1 in 1956, the difference in the returns per hundredweight from the two methods amounted to less than three cents per hundredweight, or about $5.00 per acre. In the other two years the difference was not as great as one cent per hundred pounds of potatoes sold. Only in 1954 did substantially more than half of the growers of any group get a higher price from daily pooling than they would have gotten from weekly pooling. In that year, 17 of the 25 growers who sold potatoes on six or fewer days during the season showed a small positive gain from daily pooling relative to weekly pooling.

Although the data may not cover a long enough period to be conclusive, they indicate that there is no particular group of growers who can generally and consistently sell potatoes at a greater advantage in relation to other growers on a daily price pooling basis than they could on a weekly price pooling basis. It seems that returns to individual growers from weekly price pooling is not sufficiently different from returns from daily price pooling to render weekly price pooling

TABLE 49.—Difference in prices received per hundredweight of potatoes sold by daily price pooling and what prices would have been by weekly price pooling, by number of days on which growers sold potatoes during the season, Firms 1 and 2, Hastings area, Florida, 1954-56

Number of days growers sold potatoes during season	Firm 1			Firm 2		
	Percent of growers in group	Cwt. sold per grower	Difference in price per cwt. (cents)	Percent of growers in group	Cwt. sold per grower	Difference in price per cwt. (cents)
			1954[a]			
1 - 6	41.0	2,269	0.8			
7 - 12	36.1	6,432	-0.3			
13 - 18	16.4	10,273	0.2			
19 and over	6.5	20,783	-0.4			
			1955			
1 - 6	33.3	2,788	0.1	40.0	1,142	3.1
7 - 12	35.2	5,131	1.2	28.3	5,290	-0.2
13 - 18	18.5	8,821	-1.8	16.7	9,577	-2.7
19 and over	13.0	17,100	0.3	15.0	15,453	1.3
			1956			
1 - 6	35.2	2,212	2.8	33.9	1,292	0.4
7 - 12	38.9	5,417	-3.6	26.8	5,213	-4.7
13 - 18	18.5	12,154	2.9	26.8	9,581	1.3
19 and over	7.4	10,806	-1.3	12.5	13,388	2.1

[a] Data for Firm 2 in 1954 were not obtained.

excessively inequitable among growers. It appears that weekly pooling might be a good basis for determining price to individual growers should the marketing firms operate two-row mechanical harvesting equipment on a custom basis for their patrons. This is not to say that this price pooling system would be free from other problems discussed previously in this chapter.

If the pooling period was long, some adjustment for difference in time of harvesting would need to be made as potatoes sold early usually bring a higher price. Growers whose farms are so located that they can consistently market early could not be expected to share this advantage equally with other growers. It appears that pooling prices over a long period of time, as semi-seasonal or seasonal, would not be practical because of the variation in prices over the season. However, a weekly price pool would seem to serve the same purpose and would be more desirable.

It would be desirable in any price pooling system to maintain the present practice the firms have of pooling on the basis of grades and sizes of potatoes. In addition, pooling prices during a period of a week or longer in conjunction with custom harvesting by firms would make it desirable and more equitable to include other factors in the basis for determining price to individual growers. Unless potatoes sold in any given pooling period could be harvested at approximately the same stage of maturity, including this factor would render the pool price more equitable among growers because of the effect of maturity upon yield. Those growers whose potatoes were dug at earliest stages of maturity would be deprived of the opportunity of getting maximum yield at harvest time.

Some allowance perhaps should be made for weather damage since custom harvesting by firms might deprive an individual grower of the opportunity to get his potatoes harvested before such damage occurred. However, it would be difficult to include this factor in the pricing arrangement. If the price pooling period were short enough, weather damage could probably be included without too much difficulty, with a reasonable degree of fairness to growers concerned, and without too much risk to the association. It might be best to let individual growers assume this risk.

Charges to Growers for the Harvesting Service

Two important factors in determining charges to growers for custom harvesting by firms are the basis and the amount of the charge. It has been reported that in Florida a greater number of acres and bags of potatoes can be harvested in a given amount of time when yields are high; this is because fields with higher yields have fewer weeds and grass and are generally in better condition for mechanical harvesting.[3] If this is the case and if charges were made on the basis of a flat fee per acre or per 100 pounds of potatoes, growers with high yields would be subsidizing those with low yields.

It seems that a more equitable system would base the charges on both time the harvesters were operated and acres harvested. Costs of labor, fuel, and oil comprise the major proportion of costs that vary directly with hours of operation. These items would cost approximately $10.25 per acre at a harvesting rate of .8

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[3] Spurlock, p. 62.

acre per hour, or $8.21 per hour of harvester operation of the custom unit for Plant A. Repair costs, though charged on a per acre and per season basis, are probably a function of time and of acres harvested. Other costs are primarily a function of acres covered. Thus, it would seem equitable to charge growers $8.20 per hour, or slightly more, plus so much an acre depending upon the custom harvesting unit and anticipated total per acre costs. The exact cost per hour would also vary among custom units to a small extent and would depend upon the number of trucks included in the custom harvesting unit.

Another basis of charging growers for the harvesting services might be a fixed charge per hour plus a per bag charge that varied inversely with the number of bags harvested per hour. This method is essentially the same as a fixed per hour charge plus a fixed per acre charge. However, use of a per bag charge would permit control, should the firm desire it, over the difference paid by growers whose potatoes were harvested at different rates.

CHAPTER 8

ALTERNATIVE MEANS OF OBTAINING USE OF BULK HARVESTING AND HANDLING EQUIPMENT

Custom harvesting by marketing firms is only one of several means whereby growers with small acreages of potatoes might possibly obtain the use of bulk harvesting and handling equipment. Other possibilities are custom harvesting by individuals, ownership of the equipment in partnership with other growers, and sale of potatoes in the field to packing firms or others who could afford to own bulk harvesting equipment.

Custom Harvesting by Individuals

Custom operation by individuals who own equipment is a common practice in harvesting various crops and in other farm operations in many sections of the United States. Frequently, the custom operators are farmers who operate their equipment locally to decrease per unit fixed costs. Sometimes, as is often the case in combining wheat, custom operators are individuals who move their equipment from one production area to another.

Extent of Custom Harvesting of Potatoes in Florida

Mechanical potato harvesting equipment can be moved fairly easily from one field to another and from one area to another. It can also be used in several areas in Florida and in other states. However, only a relatively small amount of mechanical harvesting of potatoes has been done on a custom basis in Florida. In the Fort Myers area in 1954 some custom mechanical harvesting was done by a harvester manufacturer to demonstrate his equipment. Some bulk harvesting has been performed on a custom basis by growers in the Hastings area, usually for the purpose of accommodating neighbors. None of the operators interviewed in 1956 indicated any desire or intention to make custom harvesting a regular practice.

In addition to custom harvesting by the harvester manufacturer and growers, one individual owned three harvesters which he operated on a custom basis in the Hastings and other areas of Florida as well as in other states. This operator harvested about 500 acres per season in the Hastings area in 1955 and 1956. He harvested for growers with large acreages and generally contracted both the harvesting and packing operations. In the 1956 season he harvested and packed potatoes for only one grower in the area. This grower owned his own packinghouse which made it easier for the custom operator to coordinate harvesting and packing and thus to keep the harvesting equipment in continuous operation. This custom operator indicated, that in order to harvest for smaller growers he would have to charge about five cents more per bag than he charged large growers. He also said his custom operation was not profitable enough and, if he could sell his equipment without taking a large loss, he would get out of the custom potato harvesting business.

Problems of Custom Harvesting by Individuals

Custom operators of bulk harvesters have had several problems in the past.[1] When bulk harvesting and handling of potatoes was first introduced in the area, packinghouses were not equipped to receive potatoes hauled in bulk and packinghouse operators were often reluctant to make the necessary changes. This lack of receiving facilities limited the opportunity for custom operators. To prevent costly stoppages of the harvesting equipment, it is necessary that the packinghouse have adequate receiving facilities, and that the harvesting and packing operations be coordinated. Thus, in the past it has been difficult, if not impossible, for custom operators to harvest for growers with small acreages, especially at a charge they could afford. The situation has improved but even at present many packinghouses are not equipped to receive potatoes handled in bulk and coordination of harvesting and packing is difficult.

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[1] Spurlock, p. 165.

Another difficulty in custom operation of bulk harvesters has been the relationship between the harvester operator and the grower. When such a new method was first used, neither the operator nor the grower can foresee all the problems involved. For example, before harvesting it may be necessary to rotobeat vines and weeds or to level ditches in the field. In some cases growers have assumed no responsibility and left such problems and expenses thereof entirely up to the custom operator. Agreements between operator and grower usually have included a flat price per unit for harvesting service, with no provision for altering the rate in view of field conditions at time of harvest or for fixing responsibility for performance of services necessary to get the field in good harvesting condition. In cases where the agreement is made just prior to harvest such factors can be taken into consideration without being mentioned specifically.

Several growers mentioned they did not have the time and if they did it would not be profitable for them to harvest for neighbors on a custom basis because of field conditions. Slow rates of harvesting, stoppages, or breakdowns because of field conditions often result in a loss to the custom operator. Thus, the growers have preferred to operate their harvesters only for themselves.

Some of the problems encountered in using mechanical harvesting have been due to differences in width of rows and of digger blades, the fact that headlands were too narrow to turn the equipment easily, and that ditches needed filling. However, there is at present sufficient knowledge about harvesting and handling potatoes in bulk that most technical problems could be foreseen and/or taken into account in agreements between the harvester operator and the grower.

It might appear that custom harvesting should be just as feasible for an individual as for a firm, providing the individual could contract for a relatively large number of acres of potatoes to harvest. However, problems faced by individuals in custom harvesting are greater than those that would be encountered by a firm. A firm should have less difficulty relative to satisfactory working relations with the growers and in obtaining field conditions desirable for successful operation of bulk harvesting and handling equipment. Coordination of the harvesting and packing operations would not be as great for a firm as for a custom operator. However, problems now faced by individuals might become less severe; if so, custom harvesting by individuals should prove both economical and desirable from the standpoint of growers.

Grower Opinions

None of the growers using the conventional system intended to have their potatoes harvested mechanically in 1957. However, 14 of the 23 growers interviewed thought custom mechanical harvesting by individuals would be a satisfactory way for those with small acreages to get their potatoes harvested, four reported they did not know and five felt it would be unsatisfactory, Table 50.

TABLE 50.--Number of growers using the conventional system of harvesting who reported specified opinions as to adequacy of custom harvesting by private individuals in the future and who reported specified problems thereof, 23 growers, Hastings area, Florida, 1956

Item	Number growers who:		All growers
	Hired all harvesting operations performed	Did some harvesting operations	
Number interviewed	6	17	23
Reported custom harvesting by individuals:			
Satisfactory	5	9	14
Unsatisfactory	0	5	5
Do not know	1	3	4
Problems reported:			
Not enough custom harvesting available	0	10	10
Custom operators do poor job	1	4	5
Timeliness of harvesting and weather damage	0	2	2
Know of no problems	5	1	6

Ten growers felt that there were not enough custom harvesters available to harvest potatoes for all growers with acreages too small to justify ownership of a harvester. Five growers felt that generally custom operators are interested only in making money and hence could not be depended upon to do a satisfactory job of harvesting. Timeliness of harvesting and possible weather damage that might result if a grower had to wait to get his potatoes harvested were given as a problem by two growers. Five of the 23 growers indicated there would be no problems in custom harvesting by individuals that they were aware of.

Joint Ownership by Growers with Small Acreages

Owning and operating two-row harvesting equipment in partnership with others is another way by which growers with small acreages might lower their harvesting costs. Eleven of the twenty-three growers who used the conventional system felt that this would be a satisfactory arrangement for some growers in the area, Table 51. However, the general feeling seemed to be that it would be satisfactory for only a small number of growers.

TABLE 51.--Number of growers using the conventional system who reported specified opinions as to adequacy of owning and operating bulk harvesting and handling equipment in partnership by growers with small acreages and who reported specified problems of such an arrangement, 23 growers, Hastings area, Florida

Item	Number growers who:		All growers
	Hired all harvesting operations performed	Did some harvesting operations	
Number interviewed	6	17	23
Reported partnership:			
Satisfactory	2	9	11
Unsatisfactory	1	1	2
Do not know	3	7	10
Problems reported:			
Order of harvesting	6	16	22
Disagreement over maintenance	0	1	1
Investment too large	0	1	1
Weather	0	1	1

A major problem reported by 22 growers was that the partners would often want to dig their potatoes at the same time, and disagreement and dissatisfaction would likely result. Price fluctuations are closely related to this problem and were mentioned often as a factor. One grower suggested that these problems might be handled by pooling on a seasonal basis the receipts from the potatoes of all the growers involved. Then it would not matter whose potatoes were dug first.

In a partnership arrangement, there would still be the problems of finding a packinghouse equipped to receive potatoes hauled in bulk and of coordinating the harvesting and packing operations. The latter problem could be difficult as one harvester cannot harvest potatoes as rapidly as a packinghouse can pack them. Thus, a packinghouse would have to pack potatoes for more than a single grower. As the number of patrons increased, especially if harvesting operations were independently performed, the problem of coordination would also increase. This problem could perhaps be worked out satisfactorily between the partners and a custom packinghouse operator. Another possibility would be for the growers to also do their own packing.

Packer Purchases and Harvests

There is another method which would seem to offer some possibility in the Hastings area. It has not been used there, but is used for other commodities in Florida. This system is the sale of the potatoes in the field to packing firms or others who then would assume responsibility for harvesting them. This method apparently works well in the citrus industry in Florida. In other areas of the

United States, canneries often contract with growers to produce vegetables for which the canning firm assumes responsibility for harvesting. There might not be enough, or any, packing firms in the area that would be interested in such an arrangement. However, it is a definite possibility and one that might be worth considering since it apparently works well in other areas and with other crops. It offers opportunity for some packing firms to handle a larger volume of potatoes and have a more economical packing operation.

Potato processors have contracted with some growers in the Hastings area for the production of potatoes in the last several seasons. The growers have assumed the responsibility of getting the potatoes harvested and packed. It might be possible that growers could interest the processors in purchasing the potatoes in the field and in assuming responsibility for harvesting them.

CHAPTER 9

SUMMARY AND CONCLUSIONS

Irish potatoes are produced commercially in six areas in Florida. Acreage and production have varied considerably since the 1919-20 season but have increased rapidly since the 1948-49 season. In the 1955-56 season 11,299,000 bushels were produced on 47,000 acres. About one-half of the total production was produced in the Hastings area and about one-fourth in Dade County. Production in the Fort Myers-Immokalee area increased from 4,100 acres in the 1955-56 season to 8,100 acres in 1956-57.

The Problems

Harvesting and handling potatoes with conventional methods requires a large amount of hand labor to pick up the potatoes, load the field containers on trucks and unload them at the packinghouse. The increase in cost of labor has made this operation expensive. In addition, potato growers report that labor has become increasingly difficult to obtain and cannot be fully relied upon when it is most needed.

Mechanical equipment, which greatly reduces the amount of man labor required to harvest and handle an acre of potatoes, has been developed and is being used in the Hastings and Fort Myers - Immokalee areas of Florida. The use of mechanical equipment if operated efficiently should result in a reduction in cost of harvesting and handling of 5 to 10 cents per packed bag. However, to own a two-row harvester and the necessary complementary equipment to harvest potatoes mechanically requires an investment of $8,000 to $10,000. Previous research indicated that in 1954 it was necessary for a unit of harvesting equipment to harvest about 120 acres for harvesting cost to be comparable to that with the conventional system.

The acres of potatoes grown by a large proportion of farmers in Florida is too small to justify the ownership of mechanical harvesting equipment. Custom harvesting is one means whereby these growers might obtain the services of such equipment.

Purposes and Methods of Study

Since individuals have not performed the service of custom harvesting, it may be feasible for potato marketing firms to own mechanical equipment and operate it for their patrons on a custom basis. This type of operation would seem to have definite possibilities in the Hastings area where a large proportion of the growers with small acreages rely on two firms, both cooperatives, to pack and sell their potatoes.

The purposes of this study were to explore the economic feasibility of custom harvesting by marketing firms, to discuss problems thereof, and to briefly consider other ways in which growers with small acreages might obtain services of bulk harvesting equipment and thus decrease their harvesting costs. To study the problem, two cooperative marketing firms in the Hastings area were selected. In 1956 these firms sold approximately one-third of the potatoes produced in the area.

About 65 percent of the volume sold by the firms was packed at packinghouses owned and operated by them.

Information used in the study was obtained from records of the firms, from random samples of their members, and from sellers of harvesting equipment. From information obtained from growers, their costs of harvesting were estimated for 1956. Estimates were also made of the cost of mechanically harvesting the potatoes packed at one plant and all plants of each firm in 1956. Costs of harvesting by the two methods were compared. Problems of custom harvesting by the firms were analyzed and discussed. In addition, possible alternative means whereby growers might obtain the services of mechanical harvesting equipment were briefly considered.

Costs of Harvesting in 1956

In 1956 the estimated harvesting costs of 23 growers who used mainly the conventional system ranged from 27 to 40 cents and averaged 33 cents per bag. Cost of growers who harvested 100 or more acres of potatoes averaged 4.5 cents per bag less than those who harvested less than 100 acres. Growers who hired all harvesting operations performed had a cost 4.5 cents per bag higher than those who hired rotobeating, picking-up, and hauling and 8.3 cents higher than those who hired only picking-up and hauling.

Cost of different harvesting operations were computed for the 12 growers who hired only picking-up and hauling. Of their total costs of 31.48 cents per bag, 13.45 cents was for picking-up and 12.43 cents was for hauling. Digging and rotobeating the potatoes amounted to only 4.25 and 1.35 cents per bag, respectively.

Four growers who harvested their potatoes with one-row harvesters had an average harvesting cost of 26.47 cents per bag. Of this amount, 14.97 cents was labor costs and the remaining 11.50 cents was equipment costs.

Costs of Harvesting with Custom Harvesting Units

Estimates were made of custom harvesting units required to harvest and haul volumes of potatoes equal to those packed daily and weekly at one plant of each firm in 1956. Estimates were also made of the equipment needed to harvest volumes equal to those packed weekly at all houses of each firm. Cost of harvesting potatoes with the mechanical harvesting units was calculated.

The amount of mechanical equipment required to harvest the various volumes of potatoes was based on the estimated rate of harvesting for an individual harvester and the maximum hours a machine would be operated. It was assumed a harvester would not be operated more than nine hours on any one day. Two rates of harvesting were assumed, 128 and 150 packed hundredweight equivalents per hour per harvester. The total number of harvester hours required to harvest the potatoes for each plant was calculated and used as a basis in estimating total amount of harvesting equipment.

At a rate of 128 bags per hour per harvester, the equipment required to harvest the volumes of potatoes packed daily in 1956 at Plant A would have cost $99,460; that required to harvest volumes packed weekly would have cost $80,310, or about $19,000 less. At a harvesting rate of 150 bags per hour, the cost of equipment required to harvest either daily or weekly volumes would have been $86,110. For Plant B, the same amount of equipment would have been required to harvest either daily or weekly volumes. Total cost of the equipment required at rates of 128 and 150 bags per hour per harvester would have been $61,160 and $64,610, respectively.

The cost of harvesting a volume of potatoes equal to those packed daily at Plant A in 1956 with mechanical equipment was estimated to be 24.88 cents per packed bag at a harvesting rate of 128 bags per harvester per hour and 22.3 cents at 150 bags per hour. The cost of harvesting the weekly volume packed at 128 bags per hour was estimated to be 21.91 cents per bag. Costs of operating the harvesters and hauling the potatoes accounted for approximately 88 percent of the total costs and were approximately equal. A little over three-fifths of the costs of operating the mechanical harvesting units were classified as fixed costs.

The estimated cost of harvesting a volume of potatoes equal to that packed at Plant B at a harvesting rate of 128 bags per hour was 29.17 cents per bag. Cost was 0.74 cent per bag higher at a harvesting rate of 150 bags per hour. The relative magnitude of different items of costs was approximately the same as for the custom harvesting units required to harvest for Plant A, except that fixed cost items accounted for 72 percent of the total harvesting cost.

The variation in total costs and the relationship between fixed and variable costs of the custom harvesting units for Plants A and B were due mainly to the difference in annual use per item of equipment. Annual use of equipment in the Plant B unit would be only 63 percent of that of the Plant A unit.

Costs of harvesting a volume of potatoes equal to that packed weekly at all plants operated by each firm were calculated only at the 128 bag per hour rate of harvesting. Estimated costs of harvesting with custom units would be 22.60 and 24.99 cents per bag for Firm 1 and Firm 2, respectively. The estimated cost of Firm 1 was 0.71 cent per bag higher than that for Plant A which was operated by Firm 1. Cost for Firm 2 was 4.18 cents per bag lower than the cost of the corresponding unit for Plant B which it operated.

The peak of the harvesting season occurred at approximately the same time in all sections of the Hastings area. Therefore, it would not have been possible to operate the equipment in more than one area and thus increase the amount of annual use.

Comparison of Costs

Growers using the conventional system had a cost of harvesting in 1956 approximately 18 and 10 cents per packed bag equivalent higher than the estimated cost of harvesting with mechanical equipment volumes of potatoes equal to those packed weekly at PlantsA and B, respectively. The cost for mechanical equipment was based on a rate of harvesting of 128 bags per hour. The cost per bag of harvesting potatoes with a one-row harvester was approximately 13 cents per bag less than the cost with the conventional system. Of the total harvesting costs, fixed costs accounted for about two-thirds for the custom harvesting unit, 14 percent for the one-row harvesters, and 11 for the conventional system.

Harvesting with the conventional system required an estimated 35 hours of man labor per acre compared with approximately 26 hours for one-row harvesters and 10 hours for the custom unit set up for Plant A. Labor costs accounted for 65 and 56 percent of the total cost of harvesting with the conventional system and one-row harvesters, respectively. With the custom units labor costs amounted to only 20 to 25 percent of total costs.

Cost of moving custom harvesters from the field of one grower to that of another was not included in the cost for the custom harvesting units. This item would amount to 0.4 cent per bag. Rotobeating, barring off rows, and leveling of ditches would be necessary in some instances. However, growers themselves would be relied upon to perform these operations.

Problems in Harvesting with Custom Harvesting Units

Growers' attitudes and opinions were unfavorable toward custom harvesting by their association. Major problems reported were investment would be too large and too many growers would want to harvest at the same time.

It would be necessary to coordinate the harvesting and packing operations if each was to be operated most economically. This would require sufficient equipment in a harvesting unit to supply the plant with enough potatoes to keep it operating continuously but not enough so the harvesters would have to stop to permit the packinghouse to catch up. Adequate supervision of the harvesting unit would be quite important in solving this problem. Supervision of the unit could be delegated to a field man, which both firms employ and who keeps in contact with both the packinghouse and growers.

Another problem would be that of order of harvesting for individual growers. Custom harvesting units could not harvest for as many growers as the plants packed for on some days in 1956. Perhaps the most satisfactory method of determining the order of harvesting would be according to planting dates. Planting dates and acreages planted by dates could be chosen by growers but it would probably be more satisfactory if they were determined and allocated in some manner by officials of the association.

Patrons of the two firms studied have traditionally been paid for their potatoes on the basis of daily pool prices. Those interviewed objected to a price pooling period of longer than one day. However, they were usually thinking only of daily price fluctuations and not the best price pooling systems to use in conjunction with custom mechanical harvesting by their firms.

With custom harvesting, in order to better coordinate the harvesting and packing operations, it might be necessary to harvest for fewer growers than ordinarily harvest and haul potatoes to a plant on given days. If this was the case, it might be desirable to pool prices over a longer period of time. Price pools of a week would be adequate from an operational standpoint. Weekly pools would be somewhat more equitable among growers in any one season than pools of a longer duration and would also likely meet with greater satisfaction among growers.

Charges to growers for custom harvesting by the firms would be a problem. A fairly equitable method would provide for charging growers on both a per acre and a per hour basis. The rate charged would depend upon the policy of the firms. They might wish to charge growers only the expected cost or they might prefer to charge a higher rate and increase refunds to the patrons.

Alternative Means of Obtaining Use of Bulk Handling Equipment

One way in which growers with small acreages might obtain the services of bulk harvesting and handling equipment would be through custom harvesting by individuals. This type of operation has been limited in the past but it might increase as problems of custom harvesting decrease. Problems faced in the past included inadequate facilities at the packinghouses for receiving potatoes hauled in bulk, too few harvester owners who wanted to do custom work, and lack of understanding and cooperation between growers and custom operators concerning problems of preparing fields for mechanical harvesting.

Of the 23 growers who used the conventional system, 14 thought that custom harvesting would be a satisfactory way for growers with small acreages to get their potatoes harvested and handled mechanically. Major problems reported were there were not yet enough harvesters in the area and that custom operators would not be interested in doing a good job of harvesting.

Joint ownership of bulk harvesting equipment might be economical for two or more growers with small acreages. A problem at times would be in agreeing on when each partner would have use of the equipment. Practically all of the growers interviewed felt that this would be the major problem, and for this reason such an arrangement would be satisfactory to only a limited number of growers.

Another alternative would be selling the potatoes in the field to potato packing firms who would assume responsibility for harvesting them. This might offer an opportunity for some packing firms in the area to increase volume and efficiency. Processors who contract for potato production might be interested in such an arrangement.

Conclusions

Custom mechanical harvesting of potatoes by the firms studied appears to be economically feasible. However, it would require a large investment in equipment, and it might also require a change in method of price pooling used by the firms. The price pooling system should include provisions for compensating growers for damage of potatoes due to weather and to factors resulting from the custom harvesting arrangement.

Major problems of custom mechanical harvesting by firms would be the unfavorable attitude of growers, coordination of the harvesting and packing operations, and determination of the price pooling system to use.

Alternative means for obtaining use of mechanical harvesting equipment should be given consideration by growers. Methods that seem to merit consideration are custom mechanical harvesting by individuals, joint ownership of equipment, and sale of potatoes in the field to buyers who would assume the responsibility for harvesting them.

APPENDIX

TABLE 52.--Acreage, yield, production, and value of Florida Irish Potatoes, by seasons, 1919-20 to 1955-56

Season	Acres for harvest	Yield per acre	Total production	Value per bushel	Total value
	(No.)	(Bu.)	(1,000 bu.)	(Dollar)	($1,000)
1919-20	22,000	96	2,112	4.00	8,448
1920-21	16,000	96	1,536	2.00	3,072
1921-22	26,000	110	2,860	1.65	4,719
1922-23	19,500	92	1,794	2.20	3,947
1923-24	28,000	88	2,464	2.14	5,273
1924-25	21,900	124	2,716	1.74	4,726
1925-26	23,100	118	2,726	3.04	8,287
1926-27	28,000	105	2,940	1.87	5,498
1927-28	31,000	126	3,897	1.48	5,785
1928-29	22,000	118	2,596	1.81	4,695
1929-30	31,000	80	2,480	1.86	4,606
1930-31	27,000	132	3,564	1.07	3,818
1931-32	21,500	70	1,505	1.28	1,933
1932-33	17,000	132	2,244	.85	1,908
1933-34	23,500	140	3,290	1.13	3,708
1934-35	24,800	97	2,405	1.04	2,504
1935-36	24,500	103	2,525	1.45	3,652
1936-37	31,300	121	3,785	1.32	4,998
1937-38	31,400	134	4,208	.70	2,960
1938-39	26,700	130	3,463	1.09	3,774
1939-40	25,600	162	4,140	.91	3,766
1940-41	26,800	117	3,129	.90	2,803
1941-42	25,000	153	3,823	1.54	5,901
1942-43	26,600	129	3,439	1.94	6,667
1943-44	28,600	112	3,212	2.00	6,431
1944-45	31,100	162	5,035	2.39	12,033
1945-46	35,300	170	6,010	1.95	11,744
1946-47	23,100	131	3,028	1.59	4,809
1947-48	20,700	170	3,512	2.50	8,772
1948-49	20,600	255	5,250	2.30	12,064

TABLE 52--Continued.

Season	Acres for harvest	Yield per acre	Total production	Value per bushel	Total value
	(No.)	(Bu.)	(1,000 bu.)	(Dollar)	($1,000)
1949-50	23,600	234	5,524	1.67	9,215
1950-51	23,500	265	6,230	1.84	11,455
1951-52	29,800	254	7,556	2.44	18,464
1952-53	40,700	248	9,749	1.61	15,674
1953-54	32,400	299	9,682	1.52	14,696
1954-55	37,600	268	10,070	2.39	24,070
1955-56	41,700	270	11,299	2.19	24,723

Source: Florida Crop and Livestock Reporting Service, Florida Vegetable Crops, Annual Statistical Summary, United States Department of Agriculture, Agricultural Marketing Service, and University of Florida Agricultural Experiment Station, Department of Agricultural Economics, Orlando, Florida, 1940-56.

TABLE 53.--Hundredweights and estimated acres of potatoes that patrons of Plant A had packed at Plant A and at all plants, except plants at Bunnell, operated by the same firm, Hastings area, Florida, 1956

Grower number	Hundredweights of potatoes packed at:		Percent of total cwts. packed at Plant A	Estimated acres[a] of potatoes packed at:	
	Plant A	All plants except at Bunnell		Plant A	All plants except at Bunnell
1	111	111	100	1	1
2	208	208	100	1	1
3	1,646	1,646	100	10	10
4	3,511	3,511	100	22	22
5	3,585	3,585	100	22	22
6	4,486	4,486	100	28	28
7	4,591	4,591	100	29	29
8	7,248	7,248	100	45	45
9	7,309	7,309	100	46	46
10	7,808	7,808	100	49	49
11	9,162	9,162	100	57	57
12	14,464	14,464	100	91	91
13	14,749	15,284	96	93	96
14	7,463	8,729	85	47	54
15	4,948	6,125	81	31	38
16	518	664	78	3	4
17	925	1,208	77	6	8
18	10,027	13,140	76	62	82
19	5,813	8,220	71	36	51
20	8,803	17,796	49	56	112
22	2,754	6,109	45	17	38
23	1,131	2,875	39	7	17
24	1,004	3,002	33	6	19
25	3,330	10,394	32	20	65
26	3,656	20,824	18	23	131
27	1,937	12,382	16	12	77
21	651	13,988	5	4	87
Total	131,838	204,869	...	824	1,280
Average	4,883	7,588	64	31	47

[a] Based on a yield of 160 bags per acre.

TABLE 54.--Hundredweights and estimated acres of potatoes that patrons of Plant B had packed at Plant B and at all plants, except plants at Bunnell, operated by the same firm, Hastings area, Florida, 1956

Grower number	Hundredweights of potatoes packed at:		Percent of total cwts. packed at Plant B	Estimated acres[a] of potatoes packed at:	
	Plant B	All plants except at Bunnell		Plant B	All plants except at Bunnell
1	208	208	100	1	1
2	1,838	1,838	100	12	12
3	3,245	3,245	100	21	21
4	3,435	3,435	100	22	22
5	13,189	13,624	97	82	85
6	5,489	5,717	96	34	35
7	7,484	7,836	96	47	49
8	12,559	13,831	91	78	86
9	5,478	6,155	89	34	38
10	649	9,360	69	4	58
11	8,456	14,703	58	53	92
12	1,548	8,595	18	10	54
Total	63,578	88,547	...	398	553
Average	5,298	7,379	69	33	46

[a] Based on a yield of 160 bags per acre.

TABLE 55.--Costs of harvesting with custom mechanical harvesting units, operated at a rate of harvesting of 150 hundredweight per hour per harvester, the volumes of potatoes packed daily and weekly at Plant A in 1956, Hastings area, Florida[a]

Items	Cost, season	Costs per	
		Acre	Packed cwt. (cents)
Tractor:			
Depreciation, interest, insurance, taxes	$ 1,400	$ 1.70	1.06
Repair	640	.78	.48
Fuel	224	.27	.17
Driver	878	1.06	.67
Miscellaneous	92	.11	.07
Total	$ 3,234	$3.92	2.45
Harvester:			
Depreciation, interest, insurance, taxes	$ 5,800	$ 7.04	4.40
Repair parts	1,854	2.25	1.41
Digger chains	824	1.00	.62
Repairman, labor	1,050	1.27	.80
Labor on harvester	2,554	3.10	1.94
Miscellaneous	55	.07	.04
Total	$12,137	$14.73	9.21
Hauling:			
Trucks and bodies:			
Depreciation, interest, insurance, taxes	$ 7,770	$ 9.43	5.89
Repair	1,500	1.82	1.14
License	435	.53	.33
Liability insurance	210	.25	.16
Drivers	3,300	4.00	2.50
Fuel	618	.75	.47
Miscellaneous	101	.12	.08
Motors	28	.03	.02
Total	$13,962	$16,93	10.59
Total, all items	$29,333	$35.58	22.25

---

[a] Costs of the unit that would be required to maintain the daily pattern and those of the unit required to maintain only weekly patterns of volumes packed in 1956 were identical.

TABLE 56.--Costs of harvesting with custom mechanical harvesting units, operated at a harvesting rate of 150 hundredweight per hour per harvester, the volumes of potatoes packed daily and weekly at Plant B in 1956, Hastings area, Florida[a]

Item	Cost, season	Cost per	
		Acre	Packed cwt. (cents)
Tractor:			
Depreciation, interest, insurance, taxes	$ 1,050	$ 2.64	1.65
Repair	480	1.21	.75
Fuel	108	.27	.17
Driver	424	1.07	.67
Miscellaneous	45	.11	.07
Total	$ 2,107	$ 5.30	3.31
Harvester:			
Depreciation, interest, insurance, taxes	$ 4,350	$10.96	6.84
Repair parts	893	2.25	1.40
Digger chains	397	1.00	.62
Repairman, labor	750	1.89	1.18
Labor on harvester	1,314	3.31	2.07
Miscellaneous	52	.13	.08
Total	$ 7,756	$19.54	12.19
Hauling:			
Trucks and bodies:			
Depreciation, interest, insurance, taxes	$ 5,698	$14.35	8.96
Repair	1,100	2.77	1.73
License	319	.80	.50
Liability insurance	154	.39	.24
Drivers	1,452	3.66	2.28
Fuel	298	.75	.47
Miscellaneous	74	.19	.12
Motors	77	.19	.12
Total	$ 9,172	$23.10	14.42
Total, all items	$19,035	$47.94	29.92

[a] Costs of harvesting daily and weekly volumes packed were identical.

TABLE 57.—Number of hundredweight of potatoes packed at all plants, except those at Bunnell, by dates, Firms 1 and 2, Hastings area, Florida, 1956

Dates	Number packed on:						
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Totals
				Firm 1			
March 22-24	...	...	...	493	837	703	2,033
March 26-31	686	1,099	1,851	2,351	1,947	706	8,640
April 2-7	1,046	1,614	2,464	3,027	3,031	2,030	13,212
April 9-14	3,370	2,731	3,801	5,553	5,496	1,007	21,958
April 16-21	3,889	4,722	6,214	6,423	5,667	554	27,469
April 23-28	6,241	7,771	1,791	2,867	10,527	8,147	37,344
April 30-May 5	11,836	13,637	13,039	14,668	14,067	5,096	72,343
May 7-12	3,292	6,789	8,241	12,517	9,336	7,775	47,950
May 14-19	12,215	14,719	14,184	14,199	16,183	6,794	78,294
May 21-26	10,956	12,450	8,873	1,298	3,841	...	37,418
May 28-30	...	497	663	...	...	...	1,160
Total	53,531	66,029	61,121	63,396	70,932	32,812	347,821
				Firm 2			
March 26-31	...	...	1,100	746	418	305	2,569
April 2-7	...	1,276	408	631	337	872	3,524
April 9-14	518	571	488	1,131	1,702	...	4,410
April 16-21	815	2,458	3,217	2,879	3,760	1,919	15,048
April 23-28	1,247	1,415	1,615	439	2,586	3,125	10,427
April 30-May 5	5,302	10,223	10,636	7,966	6,584	410	41,121
May 7-12	2,694	2,663	2,916	8,785	11,506	6,843	35,407
May 14-19	8,596	11,786	13,325	10,151	9,043	883	53,784
May 21-26	8,630	11,879	8,207	11,609	7,634	2,086	50,045
May 28-June 3	1,397	1,761	198	...	...	...	3,356
Total	29,199	44,032	42,110	44,337	43,570	16,443	219,691

SCHEDULE USED

FLORIDA AGRICULTURAL EXPERIMENT STATION
Department of Agricultural Economics

Enumerator__________Date_________

Firm__________________________

Harvesting Irish Potatoes

PART 1.

1. General

Grower's name____________________Address____________________

County_______________Location of farm____________________

2. Acres and Production

A. 1956: Acres____. Yield per acre: No._____unit and wt.___________.

B. Ave. yield last 5 years________________.

C. Per cent of production packed at Association plants in 1956___________.

D. Do you plan to change your acreage of potatoes next year? Yes__;No____.

If yes, how many acres do you plan to plant?____________________.

3. Do you attempt to space, or stagger, the dates of planting your potatoes?

Yes____; No_____.

A. If yes, describe the system you use and give reasons for using this system:___

____

4. Do you plan to change this system next year? Yes______; No______.

A. If yes, describe the system you plan to use and give reasons for changing:

____

____

5. What factors do you consider when deciding when to harvest your potatoes? (check those that apply)

Price__________

Moisture conditions_____

Maturity of potatoes_____

Others: (list) ____________________

____

____

____

6. Have you had any difficulty, in recent years, in getting your potatoes packed when you wanted them packed? Yes___; No_____.

A. If yes, nature of the problems and how handled.________________

____

____

____

7. Has the Association ever assigned quotas of potatoes to be dug on given days by individual growers? Yes_____; No_____.

A. If yes, have these quotas been of inconvenience to you?

Yes____; No____. Comments:____________________

____

____

____

8. Have you ever considered the possibilities of your Cooperative Association owning mechanical harvesting equipment and operating it on a custom basis for its patrons?

Yes___; No___. Comments:____________________

____

9. In your opinion, what would be the major problem involved in ownership and operation of mechanical harvesting equipment by the Cooperative Association? (in order of importance) ____________________

____

____

____

10. If the Co-op owned and operated mechanical harvesting equipment for its patrons, would the present price pooling arrangement work satisfactorily? Yes___; No___.

A. If no, why not?____________________

____

____

____

____

B. Would a longer price pooling period be satisfactory? Yes____; No_____.

C. If yes, what would be the most desirable length of time for the price pool, and reasons why?____________________

____

____

____

D. If B is no, why not?____________________

____

____

____

11. Is custom harvesting, by privately owned harvesters, in your opinion, a good way for small growers to get their potatoes harvested mechanically?

Yes_____; No____; Do not know______.

A. If no, why not? If yes, problems involved? ______________________

12. Do you think ownership of a mechanical harvester on a partnership basis by two or more growers would be a satisfactory way for growers with small acreages to get their potatoes harvested mechanically? Yes____; No____; Do not know___.

A. If no, why not?______________________________

B. If yes, problems involved in such an arrangement?

If grower operated mechanical harvester--questions 13 - 20.
(if not, turn to page 161)

13. In operating your harvester this year, was the harvester stopped much because trucks could not get unloaded at the packing house? Yes____; No_______.

A. If yes, about how much time was lost due to such stoppages? (hours per day or per cent of the time in the field)______________________________

____

____

B. Were workers paid during these stoppages? Yes______; No______.

Comments:______________________________________

____

____

____

14. How much time was the harvester stopped for other reasons? (List the reasons)

____

____

____

A. Were workers paid during these stoppages? Yes______; No_______.

15. Do you plan to do custom harvesting next year? Yes______; No______; Undecided_______.

A. If no, why not?______________________________

____

____

15. B. If no, would you harvest for other growers on a custom basis if these growers agreed to get their fields in good shape for custom harvesting?

16. How long would it take to change fields if the distance between fields was one mile?____________________.

A. Comments:____________________

17. In order for a farmer to be able to afford to own a mechanical harvester, what is the least number of acres that he should expect to harvest each year with it?

If grower did custom mechanical harvesting--questions 18 - 20.

18. How long before harvesting was the custom harvesting agreement made?________

19. Basis of charge for custom harvesting?____________________

20. Was any arrangement made whereby the rate charged could be altered if adverse conditions existed at the time of harvest? Yes_____; No_____.

20. A. If yes, explain:____

____

____

If grower hired mechanical harvesting--questions 21 - 23.

21. How long before harvesting were the custom harvesting arrangements made?____

____

____

22. Did you have any trouble getting custom harvesting when you wanted it?

Yes______; No______; Comments:__________________________

____

____

23. Basis of charge, (was rate dependent upon conditions at harvest time)?

____

____

If hired mechanical harvesting or used usual method--questions 24 and 25.

24. Have you ever considered buying a mechanical harvester? Yes_____; No_____.

A. If yes, why did you decide not to make the purchase?________________

____

____

____

____

25. Do you plan to hire any of your potatoes harvested mechanically next year?

Yes_____; No_______; Undecided_______.

25. A. Problems involved (also general comments).

____

____

____

____

____

____

If usual method only--question 26.

26. Do you think a mechanical potato harvester would operate satisfactorily on your farm? Yes___; No____; Do not know_____. Comments:____________

____

____

____

____

____

____

PART 2 -- COSTS

1. Rotobeating

A. Hired: Acres__________; cost per acre______________.

B. By grower, own potatoes:

01. Acres: total__________.

02. Acres per ____ hour day, each rotobeater________________.
(hrs) (acres, each machine)

03. No. of men, each machine______, wage per hour______________.

04. Make(s) of tractor(s)___________; cost per hour of operation______

________________ __________

2. Harvesting

A. Acres with conventional digger: own equipment;______; own potatoes_____;

others__________.

Hired__________; cost,__________per________________________________.

B. Acres with mechanical harvester: own equipment______________________.

Hired: cost,__________per________________.

If used mechanical harvester only, skip to question 5.

3. Labor required for digging if done by operator:

A.

Operation	Tractor		Number of men	Wage per hour	Acres per day	Hours per day
	Make	Size				
Rotobeating						
Digging:			XXX	XXX		
Tractor Dr.	XXX	XX				
Digger Op.	XXX	XX				
Supervision of: Dig, Pick-up, etc.	XXX	XX			XXX	
Checking	XXX	XX			XXX	
Bag Strowers	XXX	XX			XXX	

3. B. Cost per hour of operating tractor__________________.

C. On what per cent of the acreage were conditions: Favorable________;

Unfavorable_______; Ave. of all years__________.

4. Picking up potatoes:

A. On piece rate: Type of contract_________. Piece rate;___________

per_____including pickup_____, checking_______, hauling________,

and other (specify)______________________________________.

B. Cost if not on a "piece" basis: ______________________________

5. Acres harvested by grower with mechanical harvester. (If none, skip to question 8)

A. Own__________, others___________, total __________.

B. No. and makes of harvesters operated____________________________

Acres harvested with each harvester______, __________, __________.

C. Acres and amount harvested per day; each machine_________________.

Hours per day_____________.

6. Cost of operating the mechanical harvester:

A. Tractor cost: make and size __________________________________.

Cost per hour of use (each tractor)________________________________.

B. Labor, for each harvester, paid by grower:

	Tractor driver	Machine operator	Remove vines and trash	Pick-up potatoes
Make				
No. of workers				
Wage per hour				
Make				
No. of workers				
Wage per hour				

6. C. Other costs, per harvester:

Item	Unit	Unit Price	Amount Used (Specify time period)	Cost
Fuel (kind)				
Oil				
Grease				
Service labor				

7. Cost of hauling potatoes to packing house in bulk trucks:

A. Contract: Amount contracted____________. Cost,______per________

B. By grower:

01. No. of trucks hired_____; cost________per truck per____________
(explain fully)

02. No. of own trucks used_____. Cost per truck per hour of operation

______ _________ __________ __________ _________ _______

03. No. of hours trucks operated per day__________.

04. No. of loads per day______________________.

Amt. per load; ____________________________________.
(No.) (Unit)

05. No. of drivers hired, all trucks_____; wage per hour________.

06. Other labor used in hauling: Total no. of workers________; wage,

_________ per hour__________.

8. Cost of hauling potatoes in field sacks:

A. Contracted:

01. Amt. contracted__________. Cost and basis_____________________

____

02. No. of workers not furnished by contractor_______; if paid by grower,

wage_______________per hour______________________.

8. B. By grower:

00. No. of truck hired________; cost of each truck and basis of hire____

____

____

01. No. of own trucks used________; cost of each truck per hour of operation, excluding labor______________________________________.

02. No. of drivers hired:__________. Wage per man______per_______.

03. No. of men loading in field_______; wage per man_______________ per_______________.

04. No. of men helping drivers unload_________; wage per man________ per_______________.

05. No. of field sacks per load__________; loads per day_____________.

Hours per day trucks were operated:______________________________.

9. A. Potato Harvesting Equipment Used in 1956 (Other than tractors and trucks)

Type	Number	Make	Year Pur- chased	New or Used	Cost	Esti- mated Life	Annual Cost		Acres Covered	
							Re-pairs[1]	Misc. Expense[2]	This Farm	Other Farm
Roto-beater										
Tractor										
Digger										
Harvester										
Bulk loader										
Bulk boxes										
Motors										
Field bags										

[1] Do not include cost of digger chains.

[2] Grease, oil, service, labor, etc.

B. Cost of Digger Chains

Item	Digger	Mechanical Harvester
Make of chain		
Size of chain		
Cost per set of chains		
Acres covered per set of chains		

BIBLIOGRAPHY

Brooke, D. L. Unpublished data. Florida Agricultural Experiment Station.

Federal-State Market News Service. Potato Report, United States Department of Agriculture, Agricultural Marketing Service, Fruit and Vegetable Division, and Florida State Marketing Bureau, 1950-1956.

Florida Crop and Livestock Reporting Service. Florida Vegetable Crops, Annual Statistical Summary, United States Department of Agriculture, Agricultural Marketing Service, and University of Florida Agricultural Experiment Station, Department of Agricultural Economics, Orlando, Florida, 1945-1956.

Greene, R. E. L., Kushman, L. J., Norton, J. S., and Spurlock, H. C. Mechanical Harvesting and Bulk Handling of Potatoes in Florida and Alabama, Agricultural Economics Series No. 54-10, January, 1954, Florida Agricultural Experiment Station.

Johnson, John M. Amount of Use and Cost of Operating Farm Tractors in Florida. Unpublished Master's thesis, Department of Agricultural Engineering, University of Florida, 1954.

Norton, J. S., Greene, R.E.L., and Kushman, L. J. Equipment for Mechanical Harvesting and Handling of Irish Potatoes in the Southeast, Florida Agricultural Experiment Station Bulletin 579, November, 1956.

Spurlock, Hooper Clyde. An Economic Analysis of Mechanical Harvesting and Handling of Early Irish Potatoes in the Southeast. Unpublished Ph. D. Dissertation, Department of Agricultural Economics, University of Florida, 1956.

Stiles, H. S. Marketing Florida Potatoes, 1956 Season, United States Department of Agriculture, Agricultural Marketing Service, and Florida State Marketing Bureau, Hastings, Florida, May, 1956.

United States Department of Commerce, Bureau of the Census. Census of Agriculture, 1940, 1945, 1950, and 1955, Washington, D. C.

________. Personal interview with Dr. E. W. Cake, Marketing Specialist, Florida Agricultural Extension Service, June, 1957.

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The writer was born in Tulsa, Oklahoma on June 24, 1925. He received a Bachelor of Science degree in Agricultural Economics from Oklahoma A and M College in 1951 and a Master of Science degree from the University of Missouri in 1952.

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This dissertation was prepared under the direction of the chairman of the candidate's supervisory committee and has been approved by all members of the committee. It was submitted to the Dean of the College of Agriculture and to the Graduate Council and was approved as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

February 1, 1958

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